PB-213 375

ENVIRONMENTAL HEALTH PLANNING

Bureau of Community Environmental Management
Rockville, Maryland

1971

DISTRIBUTED BY:

NTIS

National Technical Information Service
U. S. DEPARTMENT OF COMMERCE
5285 Port Royal Road, Springfield Va. 22151

PB 213 375

COMMUNITY ENVIRONMENTAL MANAGEMENT SERIES

ENVIRONMENTAL HEALTH PLANNING

LIBRARY
Environmental Protection A
5555 Ridge Ave., Cincinnati, O.

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
U S Department of Commerce
Springfield VA 22151

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service

R
135

ENVIRONMENTAL HEALTH PLANNING

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Bureau of Community Environmental Management

1971

PREFACE

The continued success of man on this earth will be commensurate with his ability to manage and creatively adapt to his physical and social environment. If this management is to be effective in the complexities of today's urban and technologic society, it is essential that it be carefully planned and organized and that it recognize the total interrelationship of problems, programs, and the structures and will of society needed to tackle them.

There has been a growing recognition of the need for guidelines for planning effective environmental health programs by administrators of state and local programs. This culminated in a formal 1969 request by the Conference of Local Environmental Health Administrators to the Public Health Service to develop appropriate guidelines with the assistance of members from the Conference and other national environmental health organizations. This responsibility was delegated by the Administrator of the Environmental Health Service, Mr. C. C. Johnson, to the Bureau of Community Environmental Management. Representatives of each major environmental health program of the Public Health Service, and of many national professional environmental health organizations met in June 1969 to crystalize concepts and objectives. This group identified the need for a systematic approach to program planning for each component program and the need for an overall comprehensive and coordinated approach. These objectives have led to this document.

Each chapter was developed with the assistance of pertinent program personnel within the Public Health Service, utilizing insights, suggestions, and comments of representatives from national, state, and local agencies. Following an introduction briefly describing environmental health problems and the need for planning, a description is offered of urban and regional planning, comprehensive health planning, and principles of program planning. These principles are then applied to specific environmental health programs, following a consistent planning model which is adaptable to varying local problems, programs, and control efforts.

Time and circumstances did not permit extensive discussion in this edition of several relevant topics, such as land use planning, which may be added to the next edition.

It is hoped these guidelines will be helpful to environmental health administrators and planners in stimulating review, evaluation, and planning of (1) programs; (2) linkages of programs to targets; and (3) coordination of programs with other public and private efforts striving to attain and maintain a healthful environment.

Robert E. Novick

Robert E. Novick
Director
Bureau of Community
Environmental Management

PARTICIPANTS

Beard, Gary L.
Food and Drug Administration

Calbert, Clarence E.
Environmental Control Administration

Chausee, Dean R.
Environmental Control Administration

Cofrancesco, John
Environmental Control Administration

Dyksterhouse, Gerald (Retired)
Food and Drug Administration

Eller, Clyde B.
Environmental Control Administration

Erickson, F. K.
Environmental Control Administration

Fritz, John H.
Food and Drug Administration

Gallagher, Richard
Environmental Control Administration

Harris, Robert R. (Retired)
Environmental Control Administration

Herman, Harold
Health Services and Mental Health Administration

Hockman, E. L.
Environmental Control Administration

Hoseley, Frederick O.
Health Services and Mental Health Administration

Holland, Walter
Environmental Control Administration

Jacocks, Francis
Environmental Control Administration

Johnson, Wilfred
Environmental Control Administration

Katz, Gary M.
Environmental Control Administration

Keagy, Donald
Environmental Control Administration

Kelty, Edward J.
National Institute of Mental Health

Kingsley, T. H.
Food and Drug Administration

Kraeger, James A.
Environmental Control Administration

Lamphere, Edwin M.
Environmental Control Administration

LaNier, Marshall
Environmental Control Administration

Lee, Roger D.
Environmental Control Administration

Lehr, Eugene
Department of Transportation

Lovell, Leander B.
Environmental Control Administration

McCutchen, John H.
Environmental Control Administration

McMartin, H. L.
Environmental Control Administration

Meek, James W.
Department of the Interior

Michael, Jerrold M.
Environmental Health Service

Miller, George
National Institute of Mental Health

Miller, James W.
Environmental Control Administration

Miller, William C., Jr.
Environmental Control Administration

Moats, Richard A.
Environmental Control Administration

Neary, William
Environmental Control Administration

Novick, Robert E.
Environmental Control Administration

Parsons, Franklin L.
Environmental Health Service

Parsons, William
Environmental Health Service

Routt, Elizabeth
Environmental Control Administration

Schaplowsky, A. F.
Environmental Control Administration

Schock, Joseph P.
Environmental Control Administration

Scott, Harold G.
Environmental Health Service

Smith, Raymond
Environmental Health Service

Speedy, Ronald R.
Environmental Control Administration

Swain, Will N.
Food and Drug Administration

Swiecicki, Robert
Environmental Control Administration

Taylor, Darold
Health Services and Mental Health Administration

Thiebeau, Patrick A. (Deceased)
Environmental Control Administration

Thomas, James
Helath Services and Mental Health Administration

Toftner, Richard
Environmental Control Administration

Trasko, Victoria M.
Environmental Control Administration

Waldrop, Reuel
Health Services and Mental Health Administration

Williams, James
Health Services and Mental Health Administration

Wilms, Heinz
Environmental Control Administration

CONSULTANTS

Baier, Edward J.
Pennsylvania Department of Health

Ball, B. Dale
Michigan Department of Agriculture

Beal, Frank
American Association of Planning Officials

Burke, George W.
Water Pollution Control Federation

Dorer, Rowland
Virginia Department of Health

Fike, Olonzo
Maryland Department of Health

Frederick, William G.
Detroit Bureau of Industrial Hygiene

Gordon, Larry
New Mexico Department of Health and Social Services

Hale, Robert L., Jr.
National Association of Housing and Redevelopment Officials

Hope, Malcolm
District of Columbia Health Department

Hull, Bernard M.
Ohio Department of Health

Mitchell, H. Clifford
St. Louis County Health Department (Missouri)

Pickard, Ralph C.
Kentucky Department of Health

Purdom, P. Waldon
Drexel Institute of Technology

Reed, Sam
Washington State Department of Health

Senn, Charles L.
UCLA School of Public Health

Stiffman, Larry
Graduate Student
University of Michigan

Wright, Evan
Kansas Department of Health

CONTENTS

Page
INTRODUCTION 1
PLANNING 3
AIR 19
WATER 25
SOLID WASTES 31
RADIATION 37
NOISE 47
VECTORS 57
PESTICIDES 67
RESIDENTIAL 73
INSTITUTIONS 81
INJURIES 85
OCCUPATIONAL HEALTH 95
RECREATION 105
FOOD 111
DRUGS, THERAPEUTIC DEVICES, AND COSMETICS 117
OTHER PROBLEMS 123
BIBLIOGRAPHY 127
ORGANIZATIONS 137

INTRODUCTION

THE PROBLEM

Until recently, the term "ecology" was seldom heard outside the academic setting. Now, the word not only enjoys considerable currency, but there is much greater public awareness of the concept and its implications to man. Especially in the United States, man (by crowding more and more into cities; by applying at an ever-increasing rate the fruits of science to manufacturing, construction, transportation, and agriculture; and by increasing his numbers at an inordinate rate) is producing a devastating impact on the intricately and delicately balanced Earth environment. The force of man's impact seems to be increasing geometrically with time. He not only pollutes land, air and water with byproducts of his activities, but his proliferating technology evermore generates new mechanical devices, processed foods, drugs, pesticides, and other products, which pose real or potential threats to human as well as other forms of life.

Although the undesirable effect on human health and well-being of some man-caused environmental hazards has been convincingly demonstrated, the effect of others remains largely unknown and the combined effect of all of them may never be known. Most authorities agree that if environmental degradation continues to increase at present rates, man is slated for early extinction. They differ only as to how long this process will take. However, if present public concern can be expressed in substantive counter-measures, such a dire consequence may be avoided.

ENVIRONMENTAL HEALTH PROGRAMS

During this century, many activities designed to offset some of the consequences of man's impact on environment have developed. Most often conducted by state or local public health agencies, these activities have been grouped together under the label "environmental health." Their principal justification, like other public health activities, has been protection of human health. But some, especially those directed to pollution control, are also justified on the basis of other socioeconomic benefits. Environmental health programs have come about one at a time, have usually been restricted to a single problem, and have operated more or less independently. They have often duplicated one another's effort, operated at cross-purposes and competed for funds and staff. They have, then, come about largely without benefit of *planning* in the modern sense of that word.

SYSTEMATIC PLANNING

Seldom operating on a lavish scale, environmental health has, as the pace of environmental degradation sped up, fallen further and further behind in relation to the size of its problems. Current public concern for environmental problems should result in more resources being made available. However, resources will never be in unlimited supply and they must be used with utmost efficiency and effectiveness. Systematic planning and operation of environmental health programs is the best way of ensuring such efficiency and effectiveness.

Ecological perspective shows us how intricately interrelated are environmental problems. It follows that effective environmental control and improvement efforts must also be interrelated. Each program must be developed in full awareness not only of the problem toward which it is directed but also of its relation to other problems. The target problem must be defined with such accuracy and clarity that a program, truly appropriate in size and technique, can be designed. The program finally developed should represent the best of all possible options. In design and operation, full advantage should be taken of opportunities for joint action with other programs to obtain benefits of combined effort and avoid overlap and conflict. Problems should be so well defined and program rationales so thoroughly enunciated that intelligent choices can be made in allocation of resources between programs. These things can best be accomplished through systematic planning.

PURPOSE OF MANUAL

The manual is intended to guide state and local environmental health planners and managers in development of appropriate and effective programs through systematic planning—either for the development of new programs or the evaluation and upgrading of existing ones. Chapter I provides basic planning information while subsequent chapters discuss special considerations relating to planning state or local programs in each of the principal environmental health areas. Anyone primarily interested in but one program category should read Chapter I, plus the chapter dealing with that specific program, and chapters dealing with programs related to that area of interest.

PLANNING

In its most basic sense, planning is integral to all human endeavor. One of man's proudest claims to superiority over other living things is his ability to anticipate future events. He can foresee the potential effects of complex combinations of circumstances, including his own future actions. He exercises this planning faculty many times in the course of every day without really being aware that he is "planning." As civilization developed, man's individual planning skills were applied more and more to group problems. The planning process became more deliberate and formalized, and was often documented, particularly in connection with large group enterprises where it was necessary to involve many people, all of whom had to have a common understanding concerning the "why" and "what" of future actions.

Formal planning became standard practice in connection with preparations for launching large-scale government and business undertakings which would result in physical objects like roads or less tangible things like services. Most often, the planning process resulted in a written plan, wherein were recorded the rationale for and the principal conclusions and decisions regarding subsequent actions. This planning tended to be "categorical," that is, each planning group concerned itself with its own special problems with little regard for what other planning groups were doing.

Sooner or later, however, the need developed for more generalized planning which dealt with broad classes of problems. Thus arose military planning, urban planning, economic planning, transportation planning, and planning to cover just about any broad area of human experience. This planning movement has intensified in recent years. Federal and state governments presently support a multiplicity of formally-designated planning agencies, and all but the smallest local governments have full-time planning offices of one kind or another. Many federal programs created in the past few years have included specific financial support for planning. There has also been a recent trend for consolidation and coordination of planning activities to reduce competition and duplication inherent in many separate efforts. Some state governors have created planning agencies to coordinate planning activities at state level and within specially designated districts or regions in the state.

URBAN AND REGIONAL PLANNING

The twentieth century has been marked by the urbanization and suburbanization of modern society. Nowhere is this more pronounced than in the United States. In the space of a few decades, mass migration from the farms and small communities coupled with an exploding population has resulted in a society living predominately in cities or their metropolitan environs. During this continuing period of urban growth and technological development, vast changes have taken place. Air transportation with its noise and congestion, the automobile with its insatiable demand for space, miles of houses spilling over hills and farms and parks. These are marks of urban growth. So, too, is the gushing torrent of chemical and human wastes fouling our streams and beaches, the choking smog from the cars and industries; the crowding, filth and decay of our slum areas, the screeching, rending noises of our modern technology. That these results of urban development affect man's health is inescapable. The health of not only each individual but also the health of the organizations and institutions of man's society are severely affected. It is essential, therefore, that the interrelations between urban environment and man's health be understood and that we learn to profit from our experiences and past mistakes in order to better plan the further growth of our cities.

Formalized concern for the structure, function and efficiency of the city and its services is expressed through urban planning. Such planning treats with social, economic, and political factors as well as physical attributes. One of the overriding aspects of comprehensive urban planning is concern for environmental health. Since comprehensive urban planning involves political, social, and economic, as well as health considerations, there are trade-offs in the developmental processes. In evaluating these trade-offs, there is need for advice from environmental health agencies to appropriately develop the best plan for the entire community.

CURRENT STATUS

Comprehensive urban planning is a new development and only in recent years has it been widely adopted as a regular governmental activity. Much of this growth has been stimulated through grants from the U.S. Department of Housing and Urban Development (HUD) through Section 701 of the Housing Act of 1954, as amended. This act provides matching support to metropolitan, regional, and state planning agencies in the development of comprehensive plans. Other support has been provided by HUD for regional councils of governments (by Section 204 of the Demonstration and Metropolitan Development Act of 1966) and for state departments of urban planning and development. The Department of Transportation has provided specific support for the development of comprehensive plans for transportation systems. Under Bureau of the Budget leadership, states are being encouraged to establish "planning and development districts or regions" to facilitate coordination of planning activities.

Most small cities now have a planning department charged with the development of comprehensive plans for land use, transportation systems, public facilities and services, etc. As the city grows larger and extends its influence over nearby smaller communities, a county or metropolitan planning agency is often formed. As the urban area expands to become a major metropolitan complex, a regional planning agency, which may encompass many communities and counties and even cross state boundaries, is needed. Area-wide health planning agencies established under the Partnership-for-Health (Comprehensive Health Planning) program —which is described later—closely coordinate their activities with metropolitan and regional comprehensive planning agencies. Operating environmental health agencies have an opportunity, and a responsibility, to share data, information, and understanding with these planning groups.

PROBLEMS AND CONSTRAINTS

Many constraints affect development of comprehensive urban plans. Some of these affect all aspects and some are specific to environmental health. One of the principal planning constraints is the disparity between the "problem shed" and the political jurisdiction. Air pollution and refuse disposal, for example, are primarily regional problems. Relatively few areas, however, have governmental organizations with authority to develop solutions on a regional basis. A further complication results from the fact that the persons creating the problem often are not the ones who suffer the consequences. To successfully deal with solutions, governmental planning and administrative jurisdictions must cover both. Compounding all problems is the fact that urban growth is continuing at an accelerating rate. By the year 2000 there will be another 100 million people in the United States, requiring the development of 18 million acres of land and an additional 10 billion gallons of water per day to use—and treat.

Conflicting interests can create problems. Economic and political considerations may postpone or prevent desirable environmental improvements. Economically depressed areas may find it difficult to finance development of needed facilities. Parochial political interests may prevent development of cooperative approaches to problems. Planning organizations are still relatively new and in many areas are incomplete. However, urban planning and development does go on, even without adequate consideration of environmental health principles. Professor John A. Logan, President, Rose Polytechnic Institute has said, "While principles and plans are being developed, the city of the future is being 'positively planned' by the streets and highways, the sewer lines, the water lines, the reservoirs and the garbage dumps that are being built." In other words, actions are taken daily which can create additional environmental health problems unless properly planned.

ACTIVITIES

State and local environmental health agencies participate in urban and land use planning through participation in technical committees of the urban planning agencies. Such participation is outlined as follows:

A. Contribution to regulations governing:
  1. Development of residential subdivisions, commercial shopping areas, and industrial parks. Such concern includes provisions for:
    a. Adequate water supply for drinking, fire and industrial use.
    b. Adequate sewers, liquid waste treatment and disposal facilities (including private water and sewerage facilities).
    c. Adequate drainage and storm water facilities.
    d. Adequate solid waste storage and collection.
    e. Adequate air pollution control.
  2. Zoning of residential, commercial and industrial property, including consideration of population density, traffic congestion, and availability of community services.

B. Review of comprehensive or long range plans for:
  1. Land use, including overall zoning, provision of open spaces and parks.
  2. Transportation, including location of freeways, airports, and depots.
  3. Water resource management, including provisions for drinking water, recreational use, irrigation, and sewage disposal.
  4. Air resource management including industrial and residential zoning related to meteorology, topography, and air pollution.
  5. Solid waste disposal including regional plans for solid waste collection and location of future disposal sites and consideration of reclamation and recycling.
  6. Housing conservation, rehabilitation and urban renewal.

C. Review of specific plans for:
  1. Subdivisions and industrial development.
  2. Zoning.
  3. Freeways, airports, subways.
  4. Water supplies and principal water storage and distribution facilities.
  5. Principal sewers and sewage treatment and disposal facilities.
  6. Schools, hospitals, and other institutions.
  7. Parks and beaches.

D. Development of data and information systems for planning including:
  1. Housing quality inventories.
  2. Location of septic tanks, mosquito breeding areas, inadequate solid waste storage, animal pens, abandoned buildings, etc.
  3. Frequency of complaints.
  4. Levels of pollutants.

Land subdivision regulations play an important role in planning a healthful environment. Subdivision regulations are employed when raw land is converted to use by people. The greatest benefits for environmental health can be realized at the time this transition is proposed. Particular attention should be given to the following factors; will appropriate water and sewer facilities be installed; will street and pedestrian traffic patterns assure the best movement, but also maximize safety for both vehicles and pedestrians; is the siting of hospitals, health facilities, and schools appropriate; are parks and playgrounds adequate and properly located; is the design of a solid waste collection system designed for effectiveness in terms of health and efficiency. In many cases, subdivisions are proposed which are not contiguous to other populated areas and so existing community water and sewer lines are not immediately available. Under these circumstances, there will probably be a proposal advanced to use individual water sources and individual septic tanks. These should not be condoned except as a last resort measure. Alternate procedures that should be considered are listed in the Public Health Service Publication No. 1451 entitled, "Recommended State Legislation and Regulations" (for urban and individual water and sewerage systems). The location of physical facilities should be considered carefully to secure the maximum benefits possible, and minimize adverse effects. The location of industry that produces odors, noise, and air pollution should be such that their effect is minimal. This can be accomplished through their location on the side opposite from the prevailing wind and/or the use of buffer strips or green belt areas.

Roadway systems should, to the greatest extent possible, be so located that they will not have a traumatic effect by cutting through neighborhoods or act as a barrier by separating users of required facilities and work places, hospitals, and commercial areas, or produce noise and air pollution problems, or create a safety hazard for the community. Population densities should be considered so that schools will not be overloaded and private and public transportation will not pose congestion and safety problems.

The urban planning agency can also materially and substantially assist environmental health agencies by providing population data and projections, base maps, land use information, projected public facility expenditures, etc.

CONCLUSION

Experience has shown there is a compelling need for health personnel to form a firm working relationship with urban planning agencies. This partnership arrangement will produce the best design possible for the community—economically, socially, and from a standpoint of health and will assure necessary support from the politicians and citizens.

HEALTH PLANNING

Health planning, which was a relatively late arrival, has followed the same pattern of development as planning generally. Originally, measures to deal with specific health problems were planned separately and independently. Environmental health programs, in particular, were authorized by legislative bodies, one at a time, to deal with single environmental problems. Program operators felt they had fulfilled their responsibilities when they planned and conducted programs strictly as required by authorizing legislation.

The interrelatedness of environmental problems, and the consequent need for interrelated environmental control, has long been recognized and responsibility for administering several environmental health programs has been oftentimes vested in a single agency. This, however, seldom resulted in significant coordination of planning. Each program continued to operate essentially independently, striving toward its own special goals, giving little attention to possible inconsistencies between its activities and those of related programs, and seeming quite oblivious to gaps and duplications in the overall effort. The situation was even more unsatisfactory in personal health services where the governmental role was minimal and planning—other than planning for construction of individual facilities—was almost unknown. The myriad providers of personal health services, some profit-motivated and some not, were characterized by extreme independence and indifference (or active competitiveness) in their relationships with one another. They had little knowledge of environmental health in spite of its significant impact on personal health services.

COMPREHENSIVE HEALTH PLANNING (CHP)

The idea of centralized, broad-scale planning for total health services—both personal and environmental—has gained wide acceptance only recently. It is a natural consequence of the trend toward a more all-inclusive approach to planning.

A PREDECESSOR PROGRAM

A planning precedent was established in the health field by the Hill-Burton construction program. In the late 1940's it created in each state an agency responsible for systematically establishing health facility needs throughout the state. These agencies soon found that, in order to determine health facility needs, they must first determine needs for health services. Thus, they became pioneers in broad health services planning. Primarily through control of federal construction grants, the Hill-Burton state agencies have had considerable influence on the nature and distribution of health facilities built in the past 20 years, and have thus affected the whole health services system. In the early 1960's, the program stimulated creation and development of "areawide" planning agencies to coordinate individual facility planning and to estimate service and facility needs. Many of these areawide agencies have since been designated comprehensive health planning agencies and are broadening their planning in keeping with their broadened responsibilities.

PUBLIC LAW 89-749

It was this law, however, that truly ushered in across-the-board planning for health services. Authorized in 1966, the CHP* program provided grant support for establishment and initial maintenance of state and areawide planning agencies which would plan comprehensively for all health services, including environmental, in their jurisdictions. The program also provided grants for training, studies, and demonstrations in comprehensive health planning. A separate part of the program, only tenuously related to its planning activities, provided non-categorical grants to state and local agencies and organizations to help develop and support necessary health services.

CURRENT STATUS

Over half of state CHP agencies are located in the state health department, the remainder being in the Office of the Governor, or in some state agency other than health. Over 100 areawide agencies are in various stages of development. Most of these are sponsored by or are themselves voluntary private agencies. A few are affiliated in one way or another with local governments. Each provides for appropriate representation of the interests of local government. Each is responsible for part of a state or in a few instances, contiguous parts of two or more states. As a result of the training and education grants, several universities offer graduate, post-graduate and continuing education courses in comprehensive health planning.

CHP RATIONALE

CHP is intended to bring about a coordinated attack on personal and environmental health problems. It, furthermore, closely relates health planning to land-use, economic and other community planning. It replaces inefficient, piecemeal, unsynchronized pecking-away at problems via categorical efforts with a united, concentrated attack in which all resources are directed to overall goals and objectives in accordance with a single set of broad priorities. CHP provides a better justification for acquisition of new health resources. It permits intelligent allocation of all available health resources based on objective and systematic examination of (1) the relative threat posed by different health problems; (2) their susceptibility to correction by available techniques; (3) the effect of corrective measures in one problem area on other problem areas; and (4) the combined effects of simultaneous corrective measures in related problem areas. Thus, interrelationship between such activities as air pollution control and cancer treatment would influence the way in which resources are applied to those activities.

CHP AGENCIES

State and areawide CHP agencies are organized along similar lines. Each has a basic planning staff (one or more of whose members are full-time). Each also has an advisory council or board of directors comprised of appointees representative of health and related interests and the public at large. Over half of the council membership must be consumer representatives. The council or board sets policies and oversees planning. Also, subcommittees, task forces and special-study groups are formed as needed. They are manned by council members or outside experts as appropriate. CHP agencies emphasize open meetings and public airing of plans and recommendations.

---

* The original legislation was amended in 1967 by the Partnership-for-Health Amendments and the program has since gone by either name: Partnership-for-Health program, or Comprehensive Health Planning program.

AGENCY PLANNING FUNCTIONS

State CHP agencies establish broad strategy for provision of health services within the states, while areawide agencies do the same thing for intra- and interstate areas, but with greater detail and specificity and in consonance with standards and policy established by the state agencies. The state agency helps plan for and establish areawide agencies and thereafter provides them with consultation and assistance. Both kinds of CHP agencies gather data to determine quality of the environment, nature and severity of health problems, and status of health resources and services. They share data with one another to avoid duplication of effort. Based on analysis of this data, they estimate present and future health services needs and establish goals and priorities. They perform in-depth studies and analyses of problem areas and current programs. Each CHP agency closely coordinates its activities with those of urban, regional and related planning agencies, governmental and non-governmental.

A principal result of CHP activities is formulation of recommendations for changes in health services programs which, in turn, requires changes in the amounts of resources applied to health and the way in which these resources are allocated. The areawide agencies provide technical consultation and assistance to providers of services in connection with preparation of operating plans, to ensure that those plans are compatible with areawide goals, objectives, and priorities.

IMPLEMENTATION

Because CHP agencies have little legal authority to require implementation of their recommendations, it is extremely important that they work closely with regulatory and licensing agencies, health insurors, lenders of construction capital, and news media. They must involve in their planning activity respected representatives of all major health groups and providers of services, along with consumer representatives. Conformance with planning agency recommendations depends largely on how much confidence providers of services have in those involved in the planning process and on support from the public that results from consumer involvement. Neither state nor areawide comprehensive health planning reduce the necessity for planning by individual health program operators and providers of health services. They still set their individual objectives and determine the means—procedures and resources—by which they are to attain those objectives, but in keeping with the overall strategy formulated by the CHP agencies.

CHP AND ENVIRONMENTAL HEALTH PROGRAMS

The efforts of CHP agencies have meaning only to the extent that they can influence the health services delivery system (the sum of organized community activities for maintenance and improvement of health). Environmental health programs are an important part of that system. Thus, CHP agencies, which have little or no legal authority to enforce their plans, must induce the operators of environmental health activities to plan and conduct their programs in accordance with the broad CHP goals and objectives. To some extent, in the environmental health area where programs are administered by instrumentalities of government, this will be less difficult to accomplish than in the personal health services area where most operators of programs and providers of services are not directly affiliated with government. Especially at state level, where the state CHP agency is also a part of state government, provisions of that agency's plans can often be implemented by executive direction. Provisions also requiring action by the state legislature or by private industry, however, are less susceptible of ready implementation.

Areawide CHP agencies, which in most cases are not an official part of local government, must depend upon less direct means to gain adoption of their plans. Even here, however, cooperation of local environmental health programs is easier to obtain than that of other health activities because most programs are administered by local health agencies whose chief executives can decree simultaneous conformance with plan provisions by all activities under their direction. CHP agencies must be diligent in involving in their planning representatives of public health agencies, especially environmentalists, as members of their advisory councils, subcommittees, task forces and special-study groups. On the other hand, providers of environmental health services should actively seek to participate in CHP. Not only will they thereby ensure that adequate emphasis is given to environmental problems and that the technical know-how in their field is reflected in the planning, but they will also gain a better understanding of the total health problems of their state or community and their program's relative place in total health improvement.

Among those who can effectively represent environmental interests in CHP are sanitarians; sanitary engineers; public health engineers; teaching or research biologists and ecologists; civil, industrial, chemical and other environmentally related engineers; representatives of conservation organizations; members of pollution control boards and commissions; and members of civic organizations which have active environmental concerns.

CHP will probably have no sudden, dramatic impact on the way in which environmental health programs operate. Individual environmental health problems will still be dealt with essentially on an individual program basis. It will still be necessary to plan separately for the development and operation of these individual programs. However, wherever CHP has developed to the point where objectives, priorities, and relative program emphasis have been formally defined, the planners and operators of the environmental health program should make every effort to bring it into conformance with those guidelines. Furthermore, in keeping with CHP philosophy, they should be diligent in coordinating with those who plan and operate related health programs. Examples of closely related environmental health programs are air pollution control, solid waste management, water quality control and improvement of the residential environment. It is characteristic of *all* environmental health programs that each is, in some way or another, related to all others. More attention to these interrelationships will reveal opportunities to avoid overlaps, competition, and gaps and permit concerted actions with a better pay-off.

In summary, CHP consists of much more than the activities of the state and areawide agencies. Every participant in the planning and operation of health programs must become aware of the total health problem facing his locality, the total array of forces directed toward countering this problem, and the relative place of his program within this array. He must then do everything possible to improve coordination and cooperation between his and other programs, and to ensure that his program is developed and operated within the framework established by state and areawide comprehensive health agencies. The whole-hearted support by environmental health program practitioners is essential if the CHP promise of delivery to the people of more rational, effective, and economical health services is to be fulfilled.

Environmental health programs have much to gain through involvement in CHP. Their future development may, in fact, be markedly influenced to the extent that they have or have not been involved. If, through participation of environmental health experts, the CHP agency gives adequate attention to environmental problems those problems are much more likely to receive proper recognition in the establishment of priorities. Those priorities, in turn, as the influence of the CHP agency increases, will affect the amount of resources and public support applied to environmental health programs.

PROGRAM PLANNING

"Program planning" is defined as determining and describing the optimum set of activities and requisite resources necessary and attainable for counteracting an identified problem and, once those activities are underway, monitoring and evaluating them to provide a basis for the institution of modifications to keep them relevant and effective.

Environmental health program planning will most often be carried out by the same people who will administer the program, although in larger jurisdictions they may be assisted by full-time planning staffs. The kinds of manpower involved, in addition to health administrators, include program technical specialists, professional health planners, city or other land use planners, statisticians, economists, operations research specialists and various other engineering or planning specialists. In the smaller jurisdictions, however, responsibility may reside with one or two individuals with little background in planning. It will often be desirable to call upon outside technical consultants, especially where staff resources are limited, for advice during the planning process. In addition, consulting with representatives of consumer interests will bring about more realistic plans and will help ensure public acceptance of the final program. Even without an abundance of planning resources, firm resolve to plan objectively can go far toward improving the relevancy and effectiveness of programs.

At the outset, environmental health planners should become familiar with planning being done by other agencies and organizations in the state or locality. For example, planning for industrial development, highways, and zoning regulations can have important implications for environmental health plans and programs. Through close coordination and cooperation with related planning agencies, the environmental health program planner can obtain much information he needs for his own planning and expert technical advice on planning. He can avoid designing a program which is not appropriate in terms of other developments.

AN APPROACH TO PLANNING

Because systematic planning is simply a formalized and documented reasoning process, it is possible to identify certain logical principles which are adaptable to most planning situations, including health program planning. Employment of these principles by the environmental health program planner should result in programs which are realistic responses to current problems and which lend themselves to acceptance by governmental decision makers, fund appropriating bodies, and the general public.

The following paragraphs set forth a suggested program planning procedure embodying these logical principles. Although presented in a step-by-step fashion, the sequence of steps may vary in some situations and some of the steps will occur more or less simultaneously. In brief, the steps are:

1. Examine Situation
2. Set Objectives
3. Design Program
4. Implement Program, and
5. Evaluate Program.

Step 1: Examine Situation

Before developing a new environmental health program or modifying an on-going one, it is necessary to acquire as complete a picture as possible of prevailing and projected conditions having bearing on the program. The planner needs to know:

1. Nature and size of the problem.
2. Status of current control efforts.
3. Status of related environmental health problems and present and planned control activities.
4. Present and projected resources available for a new or modified program.
5. Nature of the population to be served as revealed by health status data, income data, and other demographic information.
6. Economic status and trends of the area.

7. Physical nature of the area, i.e., geography; weather; man-made features such as industries, highways, public utilities, housing; etc.
8. Other situational factors which may affect an attack on the problem, i.e., public opinion, attitude and behavior, political constraints, and state-of-the-art in control methodology and technology.

SOURCES

Data, especially statistical data, are available in overwhelming quantity and variety in this computer age. Yet, they often do not meet the needs of the program planner. Data from various sources frequently are incompatible for purposes of analysis and comparison and a surprising number of vital subject areas will be found not to be covered by data of any kind. Before he initiates his own data collecting activity, however, the program planner should become fully aware of the data that are already available.

FEDERAL DATA SOURCES

There are several publications which make it easier to locate federal statistical data:

1. *Statistical Services of the United States Government.* This Bureau of the Budget booklet describes the statistical system of the federal government, describes the principal economic and social statistical series collected by government agencies; and lists the principal statistical publications of federal agencies.
2. *Directory of Federal Statistics for Local Areas,* and *Directory of Federal Statistics for States.* Bureau of Budget guides to federal sources of greatest potential use to communities and states.
3. *Statistical Abstract of the United States.* Issued by the Department of Commerce, contains national summary data on population, economic conditions and sundry other factors.
4. The Department of Commerce publishes documents containing population summaries based on the decennial census as well as estimates of current population characteristics and future trends.
5. The Department of Commerce, via the monthly periodical *Survey of Current Business,* delineates current status and trends in key indicators of national economic conditions, including data on personal income.
6. The Department of Labor publishes the monthly *Consumer Price Index,* supplemented by quarterly and other summary reports, which sets forth trends and current status of prices of consumer goods and services.
7. The Department of Health, Education, and Welfare issues an annual compilation of national health expenditures which is published in the *Social Security Bulletin.*
8. The Department of Health, Education, and Welfare in addition to compilation of national birth and death statistics in *Vital Statistics of the United States,* issues a continuing series of reports under "Vital and Health Statistics Series 10." These reports, which deal with various aspects of the population's health status, such as days of disability, are based on the National Health Survey which consists of a continuing sampling of households and health records and physical examinations of selected population groups.
9. The Department of Health, Education, and Welfare compiles and publishes various reports including those in the "Health Manpower Source Book Series" which summarize national statistics on various health occupations, including sanitarians and sanitary engineers.

In addition to these sources, federal agencies responsible for environmental health programs issue national statistical and other informational materials pertaining to their special areas of responsibility, as do national professional organizations concerned with environmental health.

OTHER DATA SOURCES

States and most larger urban areas also boast a wide array of statistical information, often from agencies which are counterparts to the national source agencies. Information from these sources is likely to treat in detail with the state or local area with which the program planner is concerned. There is a trend toward centralizing responsibility for the gathering and maintenance of statistical data in a single state or municipal agency, thereby overcoming duplication, incompatibility, and gaps, and making it more convenient for the data seeker. Oftentimes, the best source of consolidated .health-related data will be the state or areawide comprehensive health planning agency.

After exhausting sources of presently available data, the program planner may still find he has inadequate data for planning. If resources permit he may be able to fill some of the more notable gaps through special surveys, investigations or studies to obtain first-hand information. If in-house expertise is lacking, it may be desirable to have the information gathered under contract with a private organization, or an on-going state or local information-gathering activity may be modified to cover the additional information needed by the planner. Any new data-gathering activity initiated should be designed as a continuing activity with a view to its later use as a base for monitoring and evaluating program progress. Arrangements should be made to share all information with CHP and other involved agencies.

Of the many kinds of data desirable for program planning, those which enable a clear delineation of the problem are the most essential. Even planners with few resources should not proceed until they are able to define the problem so that it can be compared in size and severity with similar problems elsewhere and quantify it so program progress can be measured. This does not mean that it is always possible to satisfactorily describe the *ultimate* problem, which is usually impact on people's health or well-being. It may be necessary to deal with factors which contribute to the ultimate problem and which, while they are themselves problems, are not the real justification for a program. For instance, the real problem toward which radiological health is directed is the deleterious effect on health of radiation from all sources. However, it is difficult to demonstrate or measure overall effect of radiation exposure on health. On the basis of limited evidence, we *assume* that there is such an effect and that by bringing about a limitation in human exposure we are contributing to better health. We accept as our problem the actual or potential occurrence of "unacceptable" amounts of human exposure to radiation. We state our newly defined problem in terms of such things as the number of a certain type of radiation-emitting device, such as X-ray machines, which pose a potential threat of overexposure, or the percentage of these which presently do not conform with prevailing safety standards. Therefore, the data needed to define the problem include the kinds, numbers, and locations of radiation sources and, of these, the number actually (or potentially, based on sampling) not in conformance with standards. Without a clear and quantified definition of the problem, there is no reasonable justification for proceeding to plan a program.

ANALYSIS

Once obtained, data require analyzing before they can serve the purposes of the program planner. They must be rearranged, combined, summarized and interpreted. The sophistication of such analyses will depend on the statistical expertise available to the planner. Thorough statistical analyses of the problem, resources, economic and health status, etc., make subsequent planning decisions easier and result in a sounder program. Non-statistical information which does not lend itself to precise analysis is also an important factor in planning. Interpretation and evaluation of public attitudes or prediction of the appropriation behavior of a state legislature involve highly subjective judgments and may have much to do with the final shape of a program. Although it is incumbent upon the planner to consider as objectively as possible the problem and the ideal response to that problem, he must also be aware of practical constraints (like public attitudes and resource shortages) if he is finally to design a program which will have a reasonable chance for implementation.

Step 2: Set Objectives

Once the problem and other aspects of the situation have been clearly determined it is possible to establish what a control program can and should do. This may be stated in form of a mission such as: "To restrict air pollution to a level that is not detrimental to human health and well-being." Much more essential and meaningful, however, is establishment of objectives which set forth specific accomplishments, within definite time periods, necessary and feasible for controlling the problem. The objectives serve as the basis for development of the actual program and serve as the basis for measuring program effectiveness. Objectives should cover all major accomplishments necessary for a successful program, both short range (within the next year or two) and long range (over at least five years). They should be consistent with overall objectives established by the agency which is to operate the program.

While setting objectives is described as a separate phase of planning, preceding program design, objectives actually are developed simultaneously with program design since it is unrealistic to attempt to set objectives without at the same time considering the general means by which they will be achieved. Wherever possible, objectives are stated in terms of ultimate effect on human beings. However, because a cause-and-effect relationship between program effort and health and well-being is often impossible to establish with our present state of knowledge, it is often necessary to establish objectives directed to problems which we assume to have an adverse effect on man. Thus objectives may be addressed to changes in environmental hazard levels, or in the behavior of polluters. An objective in occupational health might be to reduce asbestos dust levels to a certain applicable standard in a certain percentage of the asbestos-using industries in the state or locality by a certain year, whereas a more meaningful objective would be to reduce the incidence of asbestosis among industrial workers by a certain percentage within a specified time. In some cases, objectives are directed only to maintaining the status quo and thus are stated in terms of preventing the worsening of a problem during a specified time.

The importance of constructing objectives which describe specific accomplishments within a specified time cannot be overemphasized. It must be possible later to clearly determine whether or not they were accomplished.

It will facilitate program design if the objectives are ranked in priority order so that scaled-down alternative program approaches can be more readily constructed. Initial objectives will be fairly broad and few in number. While the program is being designed and even during initial operation, it is useful in addition to identify "action steps" which set forth shorter-term, more detailed program accomplishments necessary for attainment of the objectives. An action step is related to the program *means*, or activity while the objective speaks only of *ends*. An action step may involve a single activity, like training, which leads to accomplishment of an overall objective. For example, an occupational health program action step might be to train a specified number of industrial employees in dust control techniques by a certain time. Many program activities and, consequently, many action steps may be necessary for achievement of one objective. Identification of essential action steps helps guide program design by establishing requirements for certain kinds of program activities operating at a specified level and requiring specific resources. It will also facilitate evaluation of progress.

Step 3: Design Program (or Plan of Action)

The next procedure is to conceive and describe an integrated set of activities, procedures, and resources which make attainment of the objectives possible. This may involve conceiving and describing a completely new program or a modified version of an existing program. Because objectives are set up to cover a period of at least five years, the program should be projected to cover the same period. While the program's general content responds to the objectives and action steps, details of its design are worked out with experienced program administrators versed in up-to-date control methodologies and knowledgeable in technical aspects of program operation. The program should be compatible with related ongoing activities and programs to minimize duplication, gaps or competition and to foster cooperation and coordination. It should be consistent with the policies and guidelines of state and areawide CHP agencies. The program should be described in detail, with its requirements in manpower, money, facilities and equipment clearly estimated.

ALTERNATIVES

There is usually more than one reasonable program design for meeting established objectives. Therefore, alternative programs should be designed. These may vary much or little in respect to activities, procedures, or organizational arrangements. Some may be highly innovative and others more conservative. Resource requirements should be worked out completely for each so that cost comparisons can be made. For example, the objectives might be achieved by a program in injury control that included little more than public information, as opposed to an alternative which included development and promulgation of safety standards and training. For each alternative there should be at least one variation which assumes a reduced scale of operation, and a lower requirement in funds and staff. This would represent a "fallback" alternative if sufficient funds for optimum operation do not become available. The lower-scale version is based on dropping or scaling-down some objectives or scheduling them for a later date in accordance with priority ranking.

COMPARISON OF ALTERNATIVES

Once alternative approaches are established it is necessary to provide a basis for choosing between them. The description of each alternative should include estimates of the total requirements in money, manpower, and other resources for each year up to at least five years. Thus, it is easy to compare relative *costs* of the various alernatives. Estimating relative *effectiveness* of alternatives, however, is a different matter. Here we encounter the same difficulty as in identifying the problem and establishing the objectives. What is the most meaningful measure of the problem, of the objective, and of program effectiveness? Ideally we should know what impact the program might have on the health and well-being of man. But once more we are faced with the fact that present knowledge seldom permits accurate determination of the effect on man and seldom enables us to measure or predict the impact of an environmental health program on human health and well-being. To determine effectiveness then, we resort to the same measures employed in establishing the objectives. The question we will be attempting to answer will be: Which alternative program approach will best meet the objectives for the least cost?

Predictions of the future effect of a program may be imprecise. However, if the same basic assumptions are employed in estimating the impact of each alternative, even though the assumptions may not be entirely valid, the resulting estimates should provide a valid base for determining the relative effectiveness of alternatives. Once a program is under way, adjustments are always necessary to allow for errors in the original planning assumptions. The assumptions involved will cover such matters as individual work output, changes in the nature of the problem with time, and susceptibility of the problem to control techniques. Where there is a basis in experience with similar on-going programs or pilot projects, assumptions are more reliable since at least some factors, such as work output, have been measured already.

SELECT OPTIMUM ALTERNATIVE

Once reasonable effort has been made to determine relative costs and effectiveness of the alternatives, it is possible to rank the alternatives in order of potential cost-effectiveness. The planner has conceived his objectives and designed his program alternatives in full awareness of constraints. He must now confront those constraints as final limiting factors. He must identify the alternative that embodies the highest potential effectiveness for the money and which at the same time is feasible. The optimum alternative in potential cost-effectiveness may, all constraints considered, not be reasonably feasible. The alternative chosen may represent a compromise between what theoretically is most desirable and what is attainable. Estimates concerning future availability of funds usually are a principal limiting factor. Since alternative funding and staffing have been worked out for each alternative, it is possible to recommend a fairly optimistic funding level, knowing that if that level is not realized it is possible to fall back to an alternative which provides for scaled-down operation adjusted in terms of current priorities.

Many constraints are not susceptible of clear-cut analysis, including such things as public attitudes and likelihood of support from influential groups or individuals. Appraising their potential impact involves highly subjective judgments. Often the only means of dealing with these is to obtain a consensus of expert opinion, the broader the range of experts the better. Even though means of evaluating them are lacking in precision, these intangible constraints can determine the final success or failure of the program. Consequently, due allowance must be made for them, especially in the final selection of an alternative. If the alternative chosen is carefully conceived, its resource needs reliably documented, and its probable effectiveness systematically estimated, and if it accommodates the most important constraints, it has a high potential for success. A program proposal that is systematically arrived at is more acceptable to approving authorities than less well-documented competing proposals.

The final proposal should consist of a written document describing the problem and the situation, setting forth objectives and action steps, describing the recommended program approach, comparing cost-effectiveness and describing other factors that helped determine selection of the recommended approach. Since it must inform and persuade people with all kinds of backgrounds, it should be written in clear, nontechnical language.

Step 4: Implement Program

Translating the approved plan into an actual, operating program is of vital concern to the planner, especially if he is also the program administrator. Certainly, there is little virtue in planning that produces only an approved proposal that lies on a shelf. Although precise actions required to implement vary with the kind of program, certain factors must commonly be considered. It may be necessary to obtain passage of new legislation to authorize a new program or major modifications in an old one. It may be necessary to prepare regulations, guidelines and standards to be promulgated through the program. Arrangements must always be made for necessary financial support, which is often one of the most unpredictable of the situational variables. That is why the astute planner will have provided in advance for an optimum and a "fall-back" funding option based on different scales of operation. Facilities may have to be constructed or leased and supplies and equipment procured.

Organizational arrangements must be made either by establishment of a new organization or modification of an existing one. Staff must be recruited, selected and oriented. Manpower shortages can frustrate the best laid plans. During program design general availability of requisite manpower is considered in connection with determining feasibility. When severe manpower shortages are anticipated, or materialize during implementation, it is necessary to initiate the program on a limited basis, employing a skeleton staff, until arrangements are made to reduce the shortage. Recruitment and hiring of staff usually is based on the existing system of the state or local agency which is to operate the program. However, the program manager can do much to facilitate meeting manpower needs. He may arrange for reclassification of unfilled positions to achieve higher salary authorizations needed to attract appropriately skilled applicants. He may review manpower needs and arrange for employment of individuals with lesser training to perform functions traditionally performed by more highly trained manpower. He may upgrade skills of available manpower through on-the-job and short-term training sponsored by the agency, and by sending employees to universities for study in appropriate subject areas.

Descriptions of the program are disseminated to program leadership at each level and detailed operating procedures are developed to facilitate execution of procedures and activities. Most actions required in implementation are carried out in accordance with established procedures of the agency which is to administer the program.

One action which is not usually covered by an agency's standard procedures, but which is often of great significance to implementation, consists of obtaining the support of influential groups who have a natural interest in the proposed program. Depending on the program, this might include professional associations, civic and fraternal organizations, conservation organizations, government agencies, chambers of commerce, industrial groups and consumer groups. Obtaining such support is facilitated if the planner has consulted these groups during planning and has accommodated as many of their suggestions as program consistency and effectiveness will permit. Some influential groups are opposed to any program which, in order to cope with the problem, involves inconvenience or added costs to them. The program implementer must be especially diligent in seeking support from other groups to offset this opposition.

Step 5: Evaluate Program

Program planning is not a one time affair. It provides a sound basis for initiation of a new program. Once that program is under way it must be continuously monitored and evaluated so that adjustments can be made to compensate for situation changes, errors in estimates and assumptions, and spontaneous changes in program operation. Every effort must be made to ensure that the program remains relevant and effective. While the program manager is interested in the administrative efficiency of the program, the planner is primarily concerned with overall effectiveness. To make continuous monitoring and evaluation possible it is necessary to arrange for the regular gathering and analysis of information regarding the problem, program impact, and program progress. This requires regular data reporting from participants in the program as well as from other sources. Continuous monitoring enables early detection of program deficiencies and permits timely adjustments on an on-going basis.

The wisdom of establishing specific and measurable objectives and action steps becomes more apparent as the planner attempts to employ them as the test of program effectiveness. Objectives are concerned with program impact on the problem measured in changes for the better such as reduction in accident rate, vector population, pollution level, lead poisoning incidence, noise levels, or increase in rate of compliance with standards and—where possible—improvement in health status. Action steps speak of activities leading to the objective such as number of inspections, reports, and persons trained. They permit shorter-term indication of program progress. Completion of action steps, while a good indication of program progress, should not be confused with program effectiveness, which is measured only by changes to which the objectives are addressed. Regular monitoring and evaluation of the program is augmented by periodic in-depth reviews and analyses, similar to the original planning process. Once every year or two the problem and other situational factors are looked at anew and new alternative approaches are designed and compared. The selected alternative may consist of the existing program, a variation on that program, or an entirely different program approach. It must, however, take into account the on-going program. It is conceivable that, due to changed circumstances, the planners may recommend termination of program effort against a particular problem such as when the program seems to show no promise or when the problem has diminished to such a point that expenditure of further resources is not warranted.

AIR

INTRODUCTION

The air which envelopes the Earth is the life-supporting medium in which man lives, just as water is the medium in which fish exist. It is required in the combustion of fuel whereby man generates heat and power. It is used in manufacturing processes and service activities, such as chemical and biological oxidation processes, air cooling, and spray painting. The air supply is limited and must be reused. In the course of natural and artificial ventilation, used air, along with any waste products, mixes with the surrounding ambient air which is thereby polluted. Many waste products in the air are damaging, both to man and various elements of his environment. Fortunately, polluted air is subject to natural cleansing and rejuvenating. When these systems become overloaded and the tolerance of man and his environment is exceeded, man must either suffer the consequences or initiate action to preclude resulting damage and loss.

Air pollution control has been carried out from time to time and to various levels of sophistication for hundreds of years. But, until the relatively recent episodes of death-dealing smog in London, the Meuse Valley of Belgium, and Donora, Pennsylvania, such actions were generally for the purpose of lessening a nuisance. Today there is a substantial and growing realization that the ecology is changing rapidly and that man's existence as a species of this planet is threatened. Damaging air pollution is the principal result and indicator of this change. Air pollution is a regional problem. County-wide and multi-county programs have been established in various parts of the United States in recognition of this fact. Mounting effective air quality management is complex, difficult, and expensive. It involves major considerations and actions in the technologic, sociologic, economic, political, and legal arenas. Nevertheless, society has deemed that air pollution control must be achieved in order to promote man's total health and well-being.

The mission of air pollution control agencies is to reduce to a minimum the amount of pollutants emitted from existing sources and to minimize the introduction of additional pollutants from new sources. Control programs should be operated as efficiently and effectively as possible. Under the complex and difficult circumstances that prevail, a thoughtful and effective planning effort is demanded.

CURRENT STATUS OF PROGRAMS

Public Law 90–148, The Air Quality Act of 1967, is the current basic federal law and blueprint for a systematic effort to deal with air pollution in the United States. It calls for coordinated action at all levels of government and among all segments of industry and the general public. Ever since the first federal act on air pollution control in 1955, the national policy has been that basic responsibility for control rests with state and local agencies. However, in support of their efforts, the federal government conducts research, designates air quality control regions, issues air quality criteria and corresponding control technology documents, provides technical and financial assistance, and has responsibility for control of motor vehicle emissions, emissions from federal facilities, and interstate air pollution. The federal effort is focused in the National Air Pollution Control Administration (NAPCA), Public Health Service, U.S. Department of Health, Education, and Welfare. Additional federal research is carried out by the U.S. Departments of Interior, Agriculture and Commerce.

The 1967 amendments to the Clean Air Act direct the Secretary of Health, Education, and Welfare to designate "air quality control regions" as an initial step toward establishment of regional air quality management in all parts of the Nation. The designation may be either federally-initiated or state-initiated. When such designations are made, the states are required to adopt standards of air quality

Preceding page blank

and establish plans for implementation of those standards within the region. All states have now adopted state-level air pollution control legislation. Until the late 1960's, all state programs were placed organizationally as a division of the environmental health activities of the state health department. Now, several of the states have located their programs in another agency such as a department of environmental resources. There were 150 local and regional air pollution control agencies in the United States in 1969.

PROBLEMS

Despite the spectacular increased effort in the 1960's to control air pollution, the best that can be said, in most areas of the Nation, is that they've barely been able to hold the line. Both population and standard of living continue to increase and with these there is a resulting increase in the production and use of goods and services. Each year there are more automobiles, more power-generating facilities, more new chemical compounds, more manufacturing plants, more use of fertilizers and pesticides—all resulting in more sources of atmospheric emissions. Air pollution is considered to be a major factor in respiratory ailments such as lung cancer, emphysema, chronic bronchitis, and common colds. It appears to be a factor in heart disease and abnormal human behavior. It causes eye irritation. Air pollution causes economic loss due to damage to vegetation, animals, materials and visibility. It reduces agricultural productivity and reduces the salability of fruits, flowers and vegetables. It adversely affects normal growth and function of domestic animals. It damages paint and erodes metals, masonry, and air sculptures. It fades and deteriorates fabrics, and damages the connections and switches of electrical systems. It reduces visibility and thus spoils or obliterates vistas, causes airplane and vehicular accidents, delays airplane schedules, and reduces real property values.

Air pollutants are in the form of solid and liquid particulates and gases. They occur in the air in varying particle sizes, concentrations, and combinations, and problems result after anywhere from short to long exposure times, depending upon the nature of the pollutant and the sensitivity of the receptor. Odor problems occur almost instantaneously when a very low concentration of a single gaseous pollutant comes in contact with the human nose, while noticeable damage to a stone sculpture may require years of exposure to relatively high concentrations of sulfur dioxide, particulates, and humidity. Significant problems for a small area may be limited to those caused by emissions from a single "point" source, such as a smelter, power plant, paper mill or chemical manufacturing plant. For regional areas with an urban core, however, air pollution is caused by the emissions from a large number of sources, both stationary and mobile. Identification and quantification of the problem requires an evaluation of the pollutant source-receptor system of the area, considering such factors as the nature and location of pollutant sources, quantities of source emissions, topography, meteorology, and measured and predicted levels of air quality. Such evaluations serve as the basis for subsequent monitoring, emission inventory, and regulatory activities.

Assessment of the causes and effects requires a wide range of capability of technical personnel, gas and particulate monitoring equipment, and techniques and equipment for measuring damage. Control agency equipment for gases, for example, ranges anywhere from simple qualitative samplers wherein the change in color of a chemically treated piece of paper identifies the presence of a relatively high concentration of a gaseous pollutant, to a sophisticated volumetric gas chromatograph which "reads out" the identity and very low concentration of a gas in an air sample brought to the laboratory. The level of sophistication needed depends upon the degree and nature of the problem and the amount and type of regulatory authority the agency possesses.

OBJECTIVES

State and local air pollution control programs should achieve and maintain such levels of air quality as will protect human health and safety, and to the greatest degree practicable, prevent injury to plant and animal life and property, foster the comfort and convenience of the people, promote the economic development of the state, and facilitate the enjoyment of the natural attractions of the area. The most practical means of accomplishing this is through prevention and control of the emission of pollutants at their source, rather than by attempting to prevent or control their transmission through the atmosphere, to cleanse the atmosphere after it is polluted, or to protect potential receptors from coming in contact with polluted air.

The long range objective of a control program should be to achieve a level of air quality equal to or better than the stated standards desired by the area of jurisdiction, within five to ten years. The feasibility of any one agency achieving this objective is dependent upon a number of factors. A major one is the amount of authority the control agency possesses. The federal agency, for example, has preempted control of motor vehicle emissions (with some exception for California). Another is the degree of difference between existing pollutant levels and those prescribed by the standards. The greater the difference, the longer it will take to close the gap. If existing air quality is within prescribed standards, the main objective, of course, is to preserve and enhance its quality.

Some typical objectives for an air pollution control program might include:

1. Develop an emission-source inventory to cover all principal sources within urban areas within one year.
2. Develop an air quality monitoring network for gases and particulates within two years.
3. Adopt air quality standards for:
    a. Particulates by 19...
    b. Oxides of sulfur by 19...
4. Bring X% of all stationary fuel services into compliance with emission standards for SO_2 within three years.

PLAN OF ACTION

PROGRAM ELEMENTS

The major elements of a comprehensive air pollution program include:

1. Public Information. Develop an effective information and educational program to inform the community of air pollution problems, present and future, and of the need to solve them promptly and effectively. This element should be initiated as early as possible and be maintained continuously.

2. Monitoring and Survillance. There should be an emission inventory, which is kept current; a continuing assessment of the other factors affecting air quality, such as meteorology; and a continuing assessment of the adverse effects of air pollution on the citizens, their property, and their general environment. Such data are necessary in order to establish appropriate standards and regulations, to implement an enforcement program, and to properly inform citizens, public and private officials and others concerned.

3. Rules and Regulations. Promulgation of rules and regulations is most appropriately done after the problem has been assessed and evaluated and air quality standards for ambient air and source emission have been adopted. Political mandates, however, frequently compel an agency to begin exerting control before that time. In such event, several common or "standard" regulations may be promulgated, such as those which ban open burning of solid wastes or limit stack emissions of visible smoke.

4. Enforcement. Identifying polluters in violation of the law and compelling them to stop such violations is the central mission of the control agency. The acceptance and effectiveness of the program is largely dependent upon how competently and efficiently this activity is planned and carried out.

5. Training. The availability of trained personnel for employment is extremely limited and the program should provide in-service and extra-program training for its staff, not only to raise them to the level initially needed but also to maintain their competency.

6. Special Studies. In addition to routine monitoring, plans should be developed

for special studies of known or suspected problems and situations wherein additional information is needed before appropriate standards can be adopted, rules and regulations promulgated, reliable monitoring instituted, or meaningful evaluations of data and conditions made. These studies include sampling and laboratory analyses, site visits by professional staff, employment of outside consultants, photography, exposure of panels of materials, meteorological investigations, epidemiological studies, development of emergency plan, etc.

RESOURCES

The resources needed to develop this plan of action, in addition to legislative authority, budget, administrative personnel and office facilities, would be a core group of professional personnel, field monitoring and laboratory technicians, and field and laboratory equipment. The professional competencies needed include administration, engineering, chemistry, physics, biology, medicine, statistics, economics, law, public information and meteorology. If one person possesses two or more of these competencies it could lessen the number of staff required, depending upon the size of the area and the complexity of the problem. If agriculture and animal husbandry is a significant activity in the area, professional competency in this area might be warranted.

CONSTRAINTS

The constraints which need to be considered in developing the plan include those common to public agencies—opposing political pressures, lack of funds, time-consuming legal procedures, etc. Availability of experienced manpower has been a constraint for the past 15 years. The number of experienced and trained personnel in all categories is growing rapidly but so is the number of persons needed. Technical knowledge, although incomplete, is ordinarily not a constraint to mounting an effective program but needs to be considered in establishing priorities. Cooperation of management of major point sources, once a serious constraint, is now less serious but there are still problems in some industries. The most serious constraint is usually resistance generated because of the economic effects of control actions on industry or commerce. Extensive consideration of the cost/benefit situation is needed in these situations when developing the regulations, compliance schedules, etc. It is difficult, however, to place a dollar value on some of the benefits derived. It remains to be seen whether the public apathy of the past is really changing to lasting concern and determination to do what is necessary to get the job done. Until the late 1960's, this was probably the most serious constraint.

RELATION TO OTHER PROGRAMS

Solution of air pollution can be aided or complicated by other programs, and it can create problems for those other programs. This is particularly true of water quality and solid waste management. For example, solution of a sludge disposal problem by incineration can create air pollution. Improved solid waste disposal by converting from a burning dump to a sanitary landfill eliminates air pollution from that source. However, prohibition of incineration of solid wastes creates serious problems in obtaining sufficient land disposal capacities which in turn may contaminate water supplies. Opportunities exist for achieving air quality improvement by cooperation with other agencies and the inclusion of air quality considerations in other codes. Land-use planning and zoning should be coordinated with activities of the air pollution control agency in locating industrial sites, highways or other developments that may affect the ambient air. For example, building codes may contain requirements regarding incinerators, land-use and zoning may provide for open space and regulate the density of sources of emissions, highway location may consider local ventilation with respect to adjacent structures, etc.

An intergovernmental coordinating committee such as a CHP group is desirable to insure adequate communication between programs.

ALTERNATIVES

Several control alternatives may exist for meeting given air quality standards, and each alternative will have different constraints and overall costs. A process known as simulation modeling provides a useful means of identifying those control measures which will meet the standards. These alternatives are then further evaluated on the basis of workability, technical and administrative feasibility, economic impact, public priorites, effect on other programs, etc. The most effective feasible control strategy may then be selected to form the basis of the plan of action.

IMPLEMENTATION

At both the state and local levels, no single approach to the administrative organization for air pollution control can be said to be superior in all cases. The choice is dependent upon the provisions of the state constitution, current organizational patterns of the sister regulatory agencies, nature and extent of the problem, political mandates, etc. (See Bibliography for federal requirements.) The organizational structure of a state or local agency should be tailored to the needs and conditions of the area. A comprehensive state, larger metropolitan or regional program will usually include public information, legal, and business management staff, a field monitoring section, an enforcement section, evaluation section, planning section, and a laboratory section. In those agencies where there is a sizeable problem and activity, there may also be a separate research and special studies section. It may be desirable to establish a committee of technical advisors and a mechanism to hear administrative appeals. If there is an air pollution board or other body to adopt regulations, it should contain citizen representatives.

BUDGET

As with organizational structure, budget needs for individual agencies vary considerably depending upon nature of the problem, size and population density of the area of jurisdiction, number and type of regulations (permit provisions, legal procedures, test data requirements, etc.) and the degree of sophistication prescribed in the plan of action. In general, however, budget allocations will be required for salaries, travel, facilities and services, field and laboratory equipment, supplies and reference materials, public information activities, contracts, and consultation services. Present local program budgets range from a few cents to almost a dollar per capita of population served. It is felt that a minimum budget of 50 cents per capita is required for an effective and comprehensive control agency program. State program budgets will vary greatly according to such additional factors as the amount of control responsibility that has been retained at the state level, and how much and what kind of research, training, technical assistance, and financial assistance will be carried out in support of regional and local control programs. A minimum state budget should be about 25 cents per capita.

EVALUATION

Some output measures which can contribute to air pollution control evaluation are:

1. Fluctuations and trends in air quality.
2. Progress in carrying out compliance schedules for individual sources.
3. Fluctuations and trends in the number and type of emission sources and in the quantity of emissions, both for the individual sources and the total area.
4. Changes in public attitudes, interest and concern, as indicated by number and type of complaints; attendance and participation in meetings; support of budget, rule making, and enforcement hearings; and news media coverage and tone.

The evaluation methods selected are a governing factor in designing the monitoring program because they determine what kind and quantity of data are needed in order to adequately evaluate program progress.

WATER

INTRODUCTION

Americans generally assume that the water from their faucets is healthful and free of bacterial or chemical contaminants that can cause disease. Usually, the assumption is correct. The drinking water supplies in cities and towns of the United States rank in quality on the average among the best in the world. Nevertheless, there is cause for serious concern. The major findings from a recently completed Public Health Service, "Community Water Supply Study" show that: 36% of 2,600 individual tap water samples contained one or more bacterial or chemical constituents exceeding public health limits; 53% of the systems evidenced physical deficiencies in ground water sources, inadequate disinfection capacity, inadequate clarification capacity, and/or inadequate system pressure; 77% of the water plant operators were inadequately trained in fundamental water microbiology and 46% were deficient in chemistry relating to their plant operation; 79% of the systems were not inspected by state or county authorities in 1968, the last full calendar year prior to the study; and in 50% of the cases, plant officials did not remember when, if ever, a state or local health department had last surveyed the supply. Man must be protected against such physical, chemical and bacteriological health hazards. The most practical means of accomplishing this is through prevention and control of pollutants at their source, rather than by attempting to prevent or control their transmission through water courses, to cleanse water after it is polluted, or to protect potential receptors from coming in contact with polluted water.

MISSION

The mission of a water hygiene program is protection of human health through maintenance of water quality. It insures that persons do not suffer acute or chronic disease from drinking water, using recreational waters, or consuming foods grown or processed with water.

CURRENT STATUS OF FEDERAL PROGRAM

The primary federal agency with water hygiene responsibilities is the Public Health Service (PHS) of the U. S. Department of Health, Education, and Welfare (HEW). PHS establishes criteria and recommends standards of water quality for protection of health and establishes standards for potable water used by carriers subject to Interstate Quarantine Regulations. To support standard setting, PHS conducts studies to determine safe criteria and minimum standards for water quality. It supports state surveillance and control programs, and maintains a national register of public water systems. PHS interprets effects of water pollution on health, serves on the Federal Water Resources Council, and administers Interstate Quarantine Regulations relating to water supplies. Sewage and industrial waste surveillance, a responsibility of the Federal Water Quality Administration (FWQA) of the U. S. Department of the Interior (USDI) relates to water quality in receiving lakes, reservoirs, streams and estuaries. PHS has an input to this program through recommendations for maximum concentrations, in waste water, of biological and chemical constituents affecting use of water for recreation, irrigation, shellfish, and domestic supplies.

THE STATE PROGRAM

Health authority over public water supply belongs to the states. Typically, the state agency reviews and approves plans for new facilities, extensions, and modifications. It reviews operation, examines samples or receives reports of examinations, and generally oversees health aspects of water supply. The minimum facility subject to supervision varies by states from 2 to 200 premises served. When state surveillance applies only to 25 or more services, it is common for its authority to be delegated to county and local health agencies. Water supply is a function of the state health department except in Wisconsin,

Preceding page blank

New Hampshire, and New York where it has been removed to other agencies. Legislative authority varies. Generally, the state or local control agency is given authority to adopt rules and regulations necessary to discharge its surveillance responsibilities. Authority and resources are not always in balance. It is estimated that only one of five water supplies is subject to in-depth scrutiny during any one year. Changes in raw water quality and quantity, demand, deterioration of equipment, and personnel changes may adversely affect treated water quality. A visit once every 5 years is inadequate for effective surveillance. The problem usually is not quality of personnel in state and local programs, but quantity. It is estimated that state and local control agencies should have an additional 275 man-years of professional time available to meet present need.

LOCAL PROGRAMS

Supervision of private and small public water supplies is usually carried out by local health agencies. These activities may include licensing well drillers and equipment installers, issuing permits and providing construction inspections for each water supply, and providing laboratory service for bacteriological and limited chemical analyses.

WATER UTILITIES

Larger water supply and treatment facilities are usually operated and managed as utilities by public or franchised private companies. Managers, operators, engineers, chemists and others from these organizations share an interest in achieving the missions of a safe, adequate water supply. These persons, together with designers and representatives of equipment manufacturers, frequently join with environmental health personnel in the development of water hygiene standards, techniques, and training.

PROBLEMS

Despite broad acceptance of PHS Drinking Water Standards, based largely on protection from pathogenic organisms, over 6,000 of the Nation's public water supplies (serving 58 million people) do not meet those standards. As a result, disease outbreaks occur too frequently. Unfortunately, local-state-federal reporting and investigative mechanisms are inadequate to catalogue all cases of water-borne disease. Lack of state and local personnel, inadequate laboratory facilities, and untrained and underpaid water plant operators are primary contributing factors. Similarly, there is a need for improved technology in water treatment methods. PHS Drinking Water Standards are the basis for state standards. Some states have adopted them as written, some have adopted them with minor changes, some use them officially and some unofficially. No state has adopted substantially different standards. Careful reading of the Standards reveals that a high level of facility and operation are required to meet them. The surveying engineer modifies requirements as appropriate for each water supply, but the constant reference point is the Standards. While strict compliance with existing criteria and standards provide considerable health protection to the consumer, actual or potential threats to humans, perhaps more acute than those covered by existing standards, are posed by chemical contaminants, many of which pass through present-day waste and water treatment plants essentially unchanged and undiminished. Some of these, such as lead and radioactive chemicals, have cumulative, long-term deleterious effects, including chronic and incapacitating illnesses.

As our Nation grows, there is corresponding growth in the volume and complexity of chemical wastes entering rivers, lakes and underground aquifers. While precise health effects of chemical pollutants are being determined, capability to routinely test for their presence is being implemented, and methodology to remove or exclude them is being developed, the bodies of most Americans will be serving as filters and accumulators for these substances. Increased use of water for recreation and food production has resulted in greater exposure of man to threats to health and well-being because of the unsafe quality of many such waters. Conversely, certain substances found in water may have a beneficial effect on man. Fluoride as a preventive of dental caries is a well known example. It took approximately 200 years for our population to pass the 200 million mark. Estimates indicate it will take less than 50 years to reach 400 million, and that by 2020 this Nation will have a population of 468 million. In 1965, we used 269,617 million gallons of water per day; by 2020, estimated use will be 1,368,088 million gallons. To help meet projected requirements, numerous federal and state agencies are planning development of water and related land resources to insure that future water needs for domestic, municipal, industrial, agricultural, power and recreational uses are met. This development requires adequate consideration of health aspects including epidemiological assessment and disease vector control, and environmental health analysis. Failure to give adequate consideration to the health aspects during early planning may result in severe and costly health problems in the future. Projections indicate that water reuse will become more common as populations, demands for goods, and water requirements increase. The effect of impurities will be an increasing problem and input of health officials in the long-range planning process will be increasingly important.

Nation-wide problems in the field of water hygiene include:

1. Water quality does not meet existing standard.
2. Facilities not operated in accordance with accepted standards.
3. Inadequate or incomplete standards due to lack of knowledge of the relation between health and certain pollutants and contaminants found in water.
4. Inadequate knowledge and consideration of health aspects in long-term planning and development of water and related-land resources.
5. Inadequate water treatment facilities and trained operators.
6. Inadequate surveillance of contaminants of public water supplies.

State and local problems are primarily those of providing for facilities and operation that meet minimum criteria for health protection. Provision of facilities and hiring of competent operators is usually the responsibility of the water supply utility. The role of environmental health agencies is that of overseer of operation on behalf of the public to insure the continuous availability of potable water and as a catalyst for planning and providing facilities so they will be available when required. The tools are people and laboratories. In addition to people who obtain water from piped, community systems, a certain segment of the population provides its own water supply.

Increasing urbanization is steadily reducing the number of persons served by individual water supplies but the percentage still varies from around 10 to 35, depending on the areas of the country.

OBJECTIVES

Water hygiene is directed toward preventing water-borne disease and impairments to man, and toward providing adequate, safe, high quality water. Objectives indicative of the type that a state or local water hygiene program might pursue include:

1. To bring all community water supplies into compliance with state standards by 19.....
2. To increase from X to Y% the number of water supplies operated by certified personnel.
3. To increase from X to Y% the number of water supplies providing water at the optimum fluoride level.
4. To extend services of central water system to X% of the population by 19. . .

Action steps for meeting such objectives might include:

1. To conduct X training courses in water hygiene reaching Y state or local personnel during the current year.
2. To increase from X to Y the number of inspection visits during the year to supplies not currently complying with state standards.
3. To conduct an informational and motivational program in X communities

during this year to stimulate homeowners to bring their individual water systems up to state standards.

4. Attract X number of additional qualified personnel to the water quality field during the current year.

PLAN OF ACTION

The plan of action describes how the state or local agency is to reach objectives that have been established. In general, piped community water supply systems involve facilities and operations. Operation is extremely important. Conscientious operators can usually produce potable water from antiquated and run down facilities (within limits to be sure) but not even the newest and most modern equipment can overcome inept operation. For areas with piped, community water supply systems, the plan of action for a water hygiene program should be directed primarily at the operator. Mandatory certification, short schools, correspondence courses, adult education classes, and frequent visits by competent regulatory agency personnel are all part of a good program. Probably, the single most important action that will improve operators and operations is frequent visits by competent professional regulatory agency personnel. The visits should be as frequent and last as long as needed. The professional must be training-oriented and tactful in pointing out deficiencies and suggesting improvements. Properly accomplished, such visits are a powerful force for operator improvement and, hence, operations improvement.

Where responsibility for water supplies is divided according to size of the facility, planning for surveillance, training, and visits may be a function of both state and local control agencies, each according to its needs. The amount of time required for this activity varies with the complexity of the facilities and the competence of operators. Time should be provided for preparation of reports to the governing boards to make them aware of progress and needs, attendance at governing board meetings, call back for special problems, and to conduct training. The plan of action should provide approximately one health professional plus administrative and secretarial support for each 60 water supplies. If the total cost per professional, including administrative and secretarial support, is $20,000.00 per year, surveillance cost per supply is $350 per year. Where supply facilities are simple (i.e., wells with disinfection only) the time and dollar requirement is less.

Since there are limits as to how poorly physical facilities can be and still be capable of producing potable water, the plan of action must include stimulation of physical plant improvement. This is usually achieved through issuance of water supply permits only after plans and specifications have been reviewed and found to meet minimum requirements. If state laws and regulations are insufficient, a short-term objective would be to secure this necessary additional authority. State and local regulatory agencies should mutually support efforts to obtain the needed authority for each other. Plan review (of proposed facilities) presupposes the existence of design standards. If they are not in existence the plan of action should provide for their development. It should also provide for periodic review to be certain they incorporate the latest effective processes and do not become antiquated.

Laboratory services are essential to water supply operation and surveillance. If laboratory services are to be provided by the regulatory agency, the plan of action should provide for adequate space, equipment, supplies, and personnel to meet the need for service. PHS Drinking Water Standards can be used as a guide to estimate the number of samples to be processed each week. Bacteriological laboratory services should provide for a laboratory certification officer in the state laboratory whose duty it is to inspect each water plant, local regulatory, and private laboratory in the state at least once every 3 years to certify that it follows suitable procedures and that its examination results are acceptable for official assessment of water quality. Knowledge of chemical quality of water is becoming more important as natural chemical constituents are being joined by wastes from chemical manufacturing and spent chemicals washed from the soil or discarded to sewers and water courses. The plan of action should provide adequate laboratory facilities for routine testing for all constituents listed in the standards. Sample frequencies vary from every six months for supplies obtaining water from streams receiving substantial quantities of chemical waste to every 3 years for ground water supplies having records of constant chemical composition. The inventory of water supplies to be serviced will aid in estimating the sample load on the laboratory and thus establish needs for space, equipment, and personnel. Planners should consider acquisition of recently developed instruments to permit a broader range of analyses at lower detectable levels in less time and probably at less cost.

The plan of action will concern itself with other aspects of a water hygiene program. A review of enabling legislation and rules and regulations may reveal needed changes. Many may be easily accomplished but when major legislative changes are required, a careful plan to gather information needed to secure the changes must be developed. The plan should consider the changing patterns of society, movement from rural to urban areas, rapid increase in suburban development, and need for planning orderly water supply development. The plan of action must consider the work and responsibilities of all other segments of government that relate to water hygiene. Some exercise surveillance, some gather data, some plan, and still others build. Each should be identified and its specific areas of responsibility examined for overlap with others. This process may reveal areas of responsibility not currently covered. The assessment should also consider adequacy of staff and facilities of each so that possible shifts and/or mergers of responsibility can be examined. Water hygiene planners should critically review the legislative authority of each agency and the plan should identify legislation, budget, and staff needed by each.

There are a variety of regulations, administered by various agencies of government which impinge on water hygiene although they do not directly affect water supply agencies. These would include rules and regulations regarding zoning, individual water supply and sewage disposal, housing, plumbing, restaurants, milk production and processing, and utility rules. If they are inadequate, the plan should identify needed changes and describe how they will be made. Above all the plan should ensure that activities in water hygiene mesh smoothly with and complement the activities of other governmental agencies to keep costs down and efficiency up. Coordination of water quality, air quality, solid waste disposal, parks, and recreation, hydrologic and geologic surveys, housing, plumbing, occupational health and safety, and urban planning must be provided for.

IMPLEMENTATION

Implementation involves providing the necessary resources in men, facilities, and dollars to carry out the plan of action and their organization into an effective means of accomplishing the plan. Obtaining funds is usually the foremost problem in implementation. Emergency accounts are a possibility but are usually unavailable unless a health emergency exists. Legislative appropriations are the likely source. The plan should provide for a strong informational activity aimed at both the public and the legislators to document the need for the planned water hygiene program. Implementation of the plan of action may also depend on revising the authority of the state or local regulatory authority. Strengthening a state's construction permit system to enable it to become an effective tool to control the quality of new facilities might be required in some states. Clear delineation of authority to require and order in connection with certain treatment measures and facilities may be required in others. Clear placement of legal responsibility (liability) for water quality is needed in most states. The implementation phase should address itself to how these needed changes in authority and responsibility are to be obtained.

Effective and efficient utilization of existing staff and facilities is essential. Are field personnel working efficiently or is too much time consumed preparing overly long and detailed reports? Rescheduling the working hours of some laboratory personnel can often extend laboratory capacity at negligible increases in cost. Consideration should be given to whether staff time is being used to investigate problems that have been solved elsewhere and whose solutions can be easily adapted. Travel policies should be revised as necessary to encourage efficient use of staff time.

Implementation of the program may also depend on such things as:

1. legislation revising the authority of the state or local regulatory authority;
2. legislation or regulations to strengthen the permit system;
3. action to delineate authority; and
4. legislation or other actions for placement of legal responsibility (liability) for water quality.

EVALUATION

Evaluation should be based on progress in meeting the objectives. We need to measure what was done (action steps) and what is accomplished (objectives). For example, we might set as an action step, to conduct 10 short courses for 200 water treatment plant operators with the objective of improving operation of water systems by a measurable amount. For evaluation purposes we need to know how many courses were conducted and how many operators participated. Since improved operation is a goal of the water hygiene program, we also need to know what effect the training had on improving the operation of water systems. Measures of accomplishment might be the reduction in numbers of interruptions of disinfection due to operator negligence; numbers of system collecting and examining a sufficient number of bacteriological samples; numbers of systems meeting the quality standards of the Drinking Water Standards; number of new cross-connection control programs, inspections, and hazards eliminated; or numbers of certified operators when compared to the same measures of status during the base period. With this approach it will be possible to place a dollar cost on improvements. When there are alternate means to produce the same end results, they can be compared cost wise and, all else being equal, the most economical approach can be selected.

Evaluation processes should be planned to provide maximum information to program managers. If an activity needs to be evaluated monthly to determine whether changes have resulted in improvements, then it should be evaluated monthly. Laboratory changes designed to increase capacity are an example. There would be little benefit to examine laboratory performance on an annual basis as adjustments for improvement could be made much more frequently and, as a consequence, progress toward an objective of improved laboratory services could be accelerated. Examination of new travel policies to increase productivity during field trips should be made quarterly to permit continuous improvements. On the other hand, evaluations of the numbers of supplies improved may not need to be made that frequently. In addition to being a dynamic process with some phase of evaluation operating at any one time, the process itself should be evaluated to be sure it is serving its intended purpose. Evaluation for the sake of evaluation should be avoided. An effective plan should describe the evaluation process to be used. It should list the operations to be evaluated, the unit of measure, and the frequency of evaluation for each one.

SOLID WASTES

INTRODUCTION

Solid wastes are those solid materials resulting from domestic, industrial, institutional, and agricultural activities that are deliberately discarded. Solid wastes cannot be regarded in the same sense as wastes discharged into air or water. Gaseous and liquid wastes are borne by the natural transport systems of the air and water currents. Solid wastes rarely mingle or disperse and remain, sometimes, indefinitely, at rest at the place of discard. "Solid waste" more nearly describes a physical state of matter and technology—plus a human attitude—rather than the material itself, and the word 'management' is equally unrevealing of the spectrum of activities involved. This spectrum includes sources and types of materials commonly known as solid wastes together with the types of hardware and subsystems associated with storage, collection, transportation, processing, salvage, and disposal.

There is a need for salvaging, reusing, or recycling solid waste materials and physical materials should be conserved and, thus, waste prevented before it starts. The people of the United States have a potential storehouse constituted of the huge amount of solid waste materials accumulated day by day in their communities, collected from their households, piled up by industry and mines, and wasted by all concerned. If these could be used as resources, through positive, knowledgeable management, the Nation's raw materials could be conserved. At the same time communities would be more habitable, the countryside more beautiful, and the environment more suitable for living.

To help communities protect and enhance environmental quality while preserving or reusing resources is the goal of solid waste management. Such management requires that solid wastes be handled in a systematic manner that is efficient, economical, noninjurious to health, and aesthetically acceptable. Responsibility must be borne by society as a whole, by government at all levels, and by the private sector. Although the common goal is achieved by effective solid waste management, the various groups have somewhat different missions.

The federal mission is to "conduct, and encourage, cooperate with, and render financial and other assistance to appropriate public (whether federal, state, interstate, or local) authorities, agencies, and institutions, private agencies and institutions, and individuals in the conduct of, and promote the coordination of, research, investigation experiments, training, demonstrations, surveys, and studies relating to the operation and financing of solid-waste disposal programs, the development and application of new and improved methods of solid-waste disposal (including devices and facilities therefor), and the reduction of the amount of such waste and unsalvageable waste materials." (PL89-272).

The mission for state solid waste agencies should be to guide and direct municipalities and counties—through planning, legislation, regulation, evaluation, and education toward effective management of solid wastes. In addition to providing the common framework for legal action, the states are involved in financial and technical aid to local jurisdictions in achieving the desired results.

Ultimately, it is the counties, municipalities, area-wide regions, the voters therein, and the private sector, who design, construct, operate, and support effective solid waste management. Thus, the local community accomplishes actual implementation of effective solid waste management. Householders help to pass the necessary laws, approve bond issues or taxes, and reverse the attitude of individual neglect and irresponsibility.

CURRENT STATUS OF PROGRAMS

At the federal level, the Bureau of Solid Waste Management (BSWM), Environmental Health Service, Public Health Service, U.S.

Department of Health, Education, and Welfare (HEW) is the principal agency dealing with solid waste. Its activities include:

1. Research to assess present practices and to originate new or improved technology for prevention, collection, utilization, and disposal of solid wastes.
2. Technical assistance to states, regional, local and other federal agencies, private organizations, and industrial and agricultural groups on problems of solid waste management.

In addition, BSWM administers matching grants to states and interstate agencies for comprehensive solid waste planning, and other grants and contracts to local and state governments and private organizations for investigation and demonstration of the feasibility of new and improved solid waste technology. Grants are provided for graduate university training, and short-term training is provided for persons working in the field. The bureau publishes results of research, and reports regularly on progress under grants, so that this information becomes readily available to all working in the field.

Other federal agencies are also involved in solid waste management. The Bureau of Mines in the U.S. Department of the Interior is responsible for solid waste problems resulting from the extraction, processing, or utilization of minerals or fossil fuels. The U.S. Department of Housing and Urban Development (HUD) awards grants to communities for planning solid waste disposal systems. Through the Model Cities Program, HUD also aids in development of new urban techniques for solid waste management. The U.S. Department of Agriculture is concerned with disposal of feedlot wastes and plant offal and, through the Farmers Home Administration, provides assistance in construction of solid waste facilities in rural communities. The Federal Water Quality Administration of the U.S. Department of the Interior concerns itself with potential water pollution problems arising from solid waste processing and ultimate disposal. The General Services Administration, Department of Defense, Atomic Energy Commission, Bureau of Reclamation, Forest Service, and National Park Service are seeking methods of improving solid waste handling at their respective installations. Their investigations range from storage and disposal of radioactive wastes to cleanliness of campgrounds and disposal of defective bombs.

Most states and territories have received grants from the BSWM to plan statewide programs. Under this stimulus and because of public pressure, state legislatures are proceeding toward development of comprehensive plans for solid waste management.

Municipal and county ordinances on solid waste distribute regulatory authority among public works, police, licensing, and health agencies. Here, too, increasing public demand for a quality environment and the influence of state solid waste planning agencies are beginning to be felt. There are many private firms entering the solid waste management field for the first time. Solid waste handling contractors are approaching their tasks with greater care and professionalism.

Solid waste handling has traditionally concentrated on household wastes, and been mainly a municipal responsibility. Collection and disposal may be carried out by the community or by a private collector on contract, franchise or some other arrangement. Commercial and industrial establishments usually arrange for collection of their solid waste through private contract, but are often dependent upon publicly owned incinerators and landfills for ultimate disposal. Mines, farms and stock feeding establishments have accumulated mountains of wastes, but disposal of these is largely uncontrolled.

PROBLEMS

The problems of solid wastes are those of an urbanized, industrialized society. They can be summarized under eight major headings: (1) sheer quantity of wastes; (2) unsatisfactory storage, collection and disposal methods; (3) menace of solid wastes to health; (4) assault on the environment; (5) indestructibility of many solid wastes; (6) expense of handling solid waste; (7) political jurisdictions and social attitudes in the urban-suburban complex; (8) the difficulty of gaining public support.

The traditional way of considering the solid waste problem has been in terms of the collection and disposal of wastes collected from households, principally as food wastes. Realistic emphasis on all sources of solid wastes (commercial, industrial, agricultural, and mineral, as well as residential) and on all types of solid wastes, is overcoming the garbage-can concept of the solid waste problem. It has now been estimated that the total amount of solid waste generated amounts to about 3,650 million tons per year, of which the major portions are agricultural and mineral wastes. Solid wastes of urban origin are being generated at approximately 10 pounds per capita per day. Generation of industrial wastes has been estimated as equivalent to 3 pounds per capita per day. Solid wastes of agricultural origin are estimated as equivalent to 58 pounds per capita per day.

Public Health Service studies indicate that there is an association between poor solid waste practices and 22 human diseases. The rats and flies that infest dumps can and do carry disease throughout an area. The residues from burning dumps pollute the air and produce additional disease conditions. Chemicals from dumps reach into water supplies and may add waterborne disease.

These health hazards only occasionally result in the dramatic plagues of previous centuries. Usually they represent slow, cumulative impairment to health and life, involving traces of chemicals, low-level radiation, air pollution, drug residues, etc.

Workers in solid waste collection and disposal programs are three times as susceptible to disease and nine times as vulnerable to accident as the general population.

OBJECTIVES

The long-range goal for solid waste programs is to develop and implement comprehensive plans for effective, reliable, and economic handling of the Nation's solid wastes without degrading the environment, adversely affecting public health, or wasting natural resources.

Possible objectives for a state solid waste management program may include:

1. To increase from X (number) to X (number) the number of communities in the state with acceptable solid waste management systems by 19...
2. Reduce by X% the number of inadequate agricultural solid waste disposal systems contributing to pollution of water sources by 19...
3. Reduce X (number) of burning dumps in high air pollution areas within one year and eliminate X (number) of open dumps in other areas of the state within three years.
4. Expand solid waste management by establishing four regional management systems by 19...

Local government bears the major responsibility for solid waste management. Possible objectives for a local government may include:

1. Reduce all open solid wastes disposal sites by 19...
2. Reduce by X% the number of inadequate land disposal operations and incinerator facilities by 19...
3. Increase by X% the population receiving adequate solid waste collection services.

In many instances communities and counties will be unable to establish adequate collection and disposal systems without cooperating in regional groups. Such cooperation may be enabled by state legislation that provides the terms and conditions under which regional systems may be set up. CHP can play a major role here.

PLAN OF ACTION

The principle of state sanction for control and regulation of solid wastes is inherent in the state's police power. The state action plans should parallel the federal plans where appropriate, but, in addition, because of their powers of regulation and enforcement, the states have an obligation to plan, legislate, and administer programs leading to acceptable solid waste management within their respective political boundaries.

The state, unlike the federal government, is clearly responsible for full management of solid wastes within the area of its jurisdiction to create a healthful and aesthetic environment.

The state has the primary role in finding ways to gain public support for good solid waste management. Although no two states will be likely to have the same programs, for historical and other reasons, a state plan of action should include the following elements:

1. Develop, adopt, and implement a solid waste management plan.
2. Develop comprehensive state solid waste legislation to support the plan.
3. Promulgate detailed rules and regulations to provide the terms and conditions and standards for local planning, construction and operation of solid waste systems, and other matters including enforcement.
4. Enforce legislation, rules and regulations.
5. Provide a model solid waste management ordinance for regional and local jurisdictions.
6. Provide technical consultation or assistance to local jurisdictions.
7. Develop a statewide public information program.
8. Develop a statewide training program.
9. Coordinate the program at the interfaces with other agencies involved with solid waste management.
10. Prepare a plan of organization for the agency, providing it with an adequate budget, staffing and training of personnel, and stating the agency's functions.
11. Coordinate programs with land-use planning, water and air pollution control agencies, etc.

Local jurisdictions must act to improve their solid waste management systems. Prerequisite to such action is development at the local level of a comprehensive solid waste plan to anticipate future local conditions, describe present conditions, and establish objectives for financing, construction and operation. The plan should also incorporate types, capacities, and locations of processing and disposal facilities and lay the basis for adequate collection and other needed systems.

Counties and municipalities exercise state-delegated authority for constructing and operating solid waste systems. Obligations to plan, finance, and obtain public support for the needed systems are a necessary part of these responsibilities. Operating agencies must recruit and train personnel, maintain and develop good facilities, enforce local and state regulations, and be responsive to citizen complaints.

CONSTRAINTS

Constraints are national in scope and, except where indicated, apply at federal, state, and local levels.

1. *Manpower.* Engineers, scientists, sanitarians, and their co-workers are needed in government, university and private solid waste research and development projects. Economists, planners, scientists, engineers, sanitarians, administrators and managers are needed at all operating and administrative levels. First-rate problems need first-rate solutions, which must be found by first-rate minds. Until recently, the field of solid waste management has not attracted the high caliber workers, nor the variety of skills and learning needed to solve or to manage the national solid waste problem at any level.
2. *Knowledge.* There remains an absence of firm and specific data on physical characteristics, quantities, and costs of solid wastes, as well as on the social constraints of their management. There is also a lack of knowledge of management skills and of accepted technologies of solid waste handling.
3. *Money.* At the present time the United States spends over $4.5 billion per year for solid waste management. These monies do not provide for adequate collection and disposal systems in the United States. Part of the high cost of solid wastes collection (in relation to service performed) results from inefficiencies of largely manual service with an absence

of rational labor management practices. Low wages, high turnover, inadequate training have been accompanied by a high incidence of occupational hazard.

4. *Political Mandate.* Public attitude toward solid wastes is amply illustrated by prevalent practices and habits. Open (and often burning) dumps, smoking commercial and industrial waste burners, derelict vehicles abandoned on city streets and rural lanes, side-of-the-road dumps, and general litter. This is a public attitude that still oscillates from a complete disregard for the problem of waste materials once they have been removed from the premises to an unreasoning and adamant opposition to any solid waste facility in the environs, with no rational middle view. It is this attitude of public neglect that until recently has permitted lack of plans and modern legislation for solid waste management at state and local levels, which demonstrates an insufficient appreciation of the need for them, and which makes it impossible in many cases for those responsible for solid waste management to plan, administer, or control effectively.

IMPLEMENTATION

The plan of action is based on identified problems and established objectives. The implementation and scope of the program is dependent on program resources and their effective use. The principal ingredients of a program are organization, legislation, personnel, training, and budget.

EVALUATION

The basic measure of solid waste program effectiveness is the health and well-being of the people. Since this is difficult to demonstrate, it is more usual to turn to the evaluation of action steps leading toward the basic goal. One such important measure of effectiveness is in terms of the increased number of communities with acceptable solid waste systems. The first national survey has made a beginning on the types of data which would enter into such an evaluation and should have provided a bench mark. Unfortunately, however useful for other purposes, the data is of considerable unevenness and throws into question the validity of the bench mark.

Evaluation will have to start with a sampling from local areas of various sizes and locations and should be undertaken with state advice and assistance. The kinds of information to be covered should include: acceptability of collection systems, storage regulations, reduction and disposal facilities from the point of view of health and aesthetics. Just the mention of such considerations raises the need for generally accepted standards which can be applied in appraising the systems, and such standards are only beginning to be formulated.

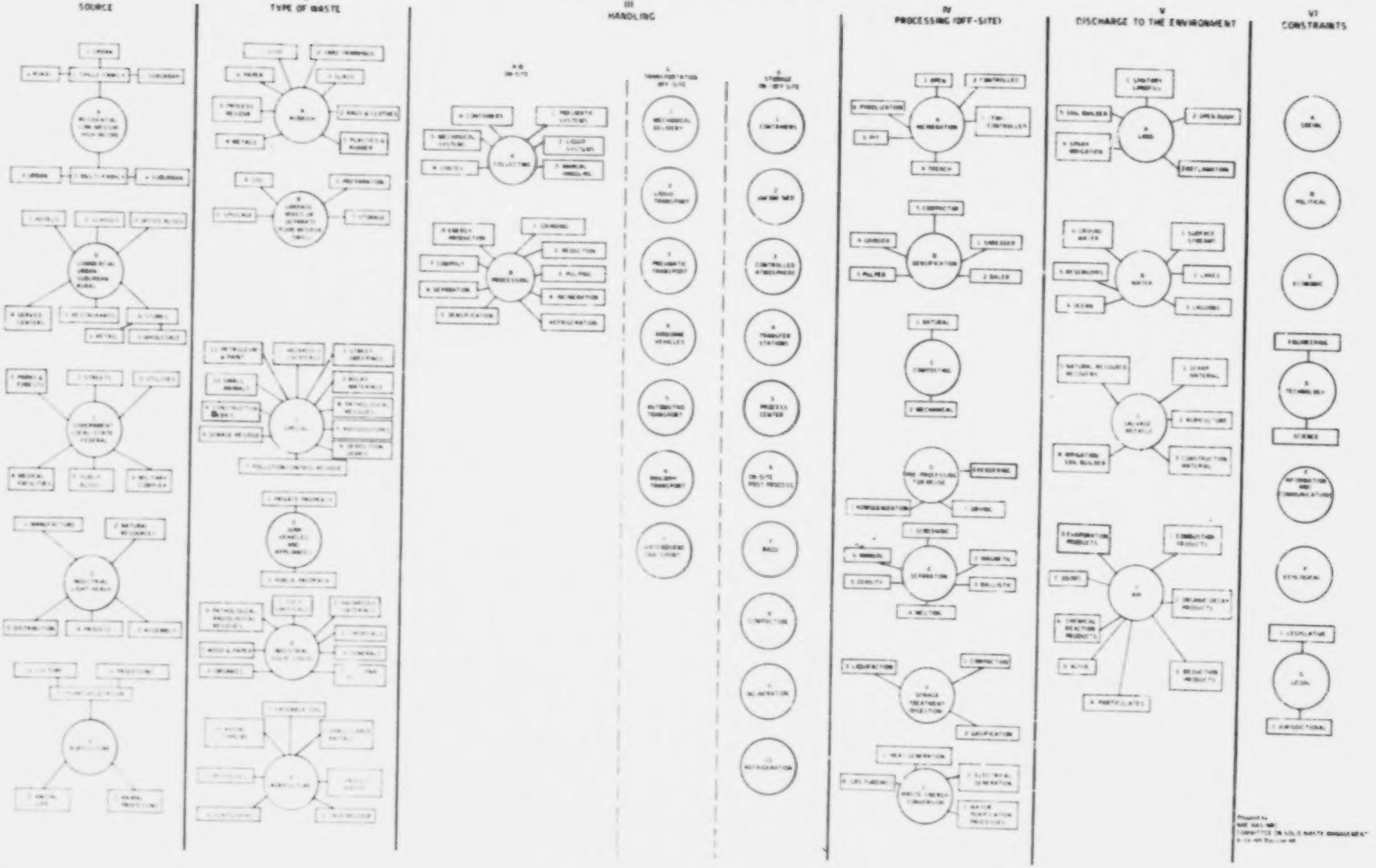
CONCLUSION

To repair the scars left by a hundred years of indiscriminate dumping and community negligence will take time and money. Because we are an economically advanced country, our wastes increase even faster than our population. Since legislation usually follows awareness of a problem rather than anticipating it, the change in both individual and community patterns of behavior is likely to be slow.

If we can show in two years' time that a substantial number of open dumps have been closed down and the necessary number of sanitary landfills substituted for them, we shall have an important evaluation yardstick. But if the wastes continue to pile up in backyards, factories, mines, and fields, we shall have achieved no change in the quality of our environment.

If in 10 years' time we are still thinking in terms of dumping and burning, rather than in concepts of reusing and recycling, we shall have made no progress in conserving resources or developing a better life for our people.

FIG. 1. SOLID WASTE MANAGEMENT STUDY MATRIX


I SOURCE
II TYPE OF WASTE
III HANDLING
IV PROCESSING (OFF-SITE)
V DISCHARGE TO THE ENVIRONMENT
VI CONSTRAINTS
A LAND
1 SANITARY LANDFILL
2 OPEN DUMP
B WATER
1 SURFACE STREAMS
2 LAKES
3 LAGOONS
C SALVAGE MATERIALS
D AIR
4 PARTICULATES
A SOCIAL
B POLITICAL
C ECONOMIC
ENGINEERING
D TECHNOLOGY
SCIENCE
E INFORMATION AND COMMUNICATIONS
F ECOLOGICAL
1 LEGISLATIVE
G LEGAL
2 JURISDICTIONAL

RADIATION

INTRODUCTION

Radiation, properly utilized, is instrumental in improving human health and well-being. The application of x-ray and radioisotopes in clinical diagnosis and therapy; radioisotopes in industry (for measuring, testing and processing); electric power generation; microwave cooking equipment; and lasers (in science, industry and medicine) are just a few examples of beneficial application of radiation.

Exposure to radiation can result in biological damage which may not be immediately apparent. The damage manifests itself in various ways and the timetable of effects-versus-exposure varies widely depending upon the type of radiation, the duration and magnitude of exposure, and portion of the biological system exposed. There are delayed somatic effects such as leukemia, reduced life span, precancerous lesions, and neoplasms which do not appear for years following an acute or a long-term chronic exposure; and there are also those genetic effects (mutations affecting progeny of irradiated persons) which do not become apparent for many generations.

In 1959, the Federal Radiation Council (FRC) was formed in the United States to provide a federal policy on human exposure to ionizing radiation. FRC adopted the position that any radiation exposure of the population involves some risk; the magnitude increasing with the exposure. Thus, FRC accepted, for standards setting purposes, the linear or non-threshold concept of the biological effects of ionizing radiation from firm evidence of the effects of high dose and the lack of evidence that low dosages do not produce biological effects. The principal mission of the public and private organizations interested in radiation protection is to minimize exposure of the general population to unnecessary ionizing and non-ionizing radiation from all controllable sources.

RADIATION CONTROL RESPONSIBILITIES

Radiation control in the United States is shared among various local agencies, the states, the U. S. Department of Health, Education, and Welfare (HEW), the Atomic Energy Commission (AEC), and other federal agencies. The states have the primary responsibility and authority for the control of the use of radiation sources.

FEDERAL AGENCIES

Within the federal structure, AEC and HEW have primary responsibility for radiation control. Under the Atomic Energy Act of 1954, as amended, AEC administers a program to encourage development and use of atomic energy for peaceful purposes to the maximum extent consistent with the common defense and security and with the health and safety of the public. Under Section 274 of this Act, as amended, AEC has entered into agreements transferring to a number of states licensing and regulatory authority with respect to by-product material, source material, and special nuclear materials in quantities insufficient to form a critical mass.

Within HEW, the Public Health Service (PHS) has been delegated radiological health responsibility. PHS measures radiation in the environment, estimates human exposure, performs research on the effects of radiation exposure and directs a nationwide program to reduce radiation hazards to the public, including control of electronic product radiation. PHS develops and administers performance standards to control radiation emission from electronic products, studies and evaluates exposures from electronic product radiation and intense magnetic fields, conducts or supports research, training, development and inspections to control and minimize such hazards, and tests and evaluates effectiveness of procedures and techniques for minimizing such exposure. PHS also has responsibility for the safe use of radiation in food processing and in the use of radiopharmaceuticals of biological orgin, criteria for air quality and drinking water standards for potable water use by carriers subject to the federal quarantine regulations.

Other federal agencies with direct responsibility for the control of radiation health hazards include:

1. The U. S. Department of Transportation, through the Hazardous Materials Regulations, controls the transportation and packaging of radioactive materials.
2. The U. S. Department of the Interior controls health hazards from ionizing radiation in the mineral extractive and related industries, principally the control of radon daughters in uranium mining. The department also establishes criteria for surface water quality.
3. The U. S. Department of Labor controls radiation hazards to employees of certain federal contractors (Walsh-Healey and McNamara-O'Hara Acts) and employees in certain occupations (Longshoremen and Harbor Worker's Compensation Act).

STATE AND LOCAL AGENCIES

State and local radiological health programs have major responsibilities for control of ionizing and non-ionizing radiation hazards from the use of electronic products as well as naturally occurring and accelerator produced radioactive materials. At the state level, responsibilities for radiological health activities are usually administered by health departments, with activities shared with departments of labor or atomic energy in four states. As of January 1, 1970, 47 of the 53 states and territories had passed legislation to authorize the control of ionizing radiation and 46 states had promulgated regulations. Only two states had neither passed legislation nor implemented regulations for control of ionizing radiation. Eight states had specific authority to control one or more sources of non-ionizing radiation (i.e., lasers, microwaves). Prior to January 1, 1970, 22 states had assumed responsibility for the control of radioactive material previously under regulatory jurisdiction of AEC. Although the majority of states have radiological health regulations, there is considerable variation in specific control features. Use of model regulations by states is one means by which compatibility among state programs is being improved. Fifty percent of the states have now used most of the model regulations recommended by the Council of State Governments.

Radiological health activities at the local level are limited. Only in six states (Alabama, California, Florida, New York, Michigan and Pennsylvania) is an active program identifiable at a city-county level. A comprehensive radiological health program requires technical and scientific disciplines usually not available to most local agencies and expensive equipment which requires a considerable initial expenditure of funds. In addition, most state laws require the local codes be identical to or as stringent as state regulations. However, local agencies can and do effectively operate limited radiological health programs or provide valuable assistance to state programs. Local programs may be responsible for specific radiation sources such as industrial x-ray machines or the program may locate radiation sources and collect environmental samples for the state program. In some instances, the city or county contracts with the state to implement provisions of the state regulations.

PROBLEM DEFINITION

Sound program development requires that radiological health problems be defined and their magnitude determined. The public health significance of any specific source of radiation is related to (a) number of sources in use, (b) anticipated growth rate, (c) population at risk, (d) relative toxicity, and (e) length of exposure. The public health significance of any particular source of radiation must also consider the source in relation to the other radiation sources of all types within the environment. Problem identification is necessary to permit rational administrative and functional planning (planning staff requirement, financial needs, instrumentation and laboratory requirements, etc.). Examples of problem areas include:

1. Electronic devices capable of producing radiation which is incidental to their use or which may emit radiation by design. These include but are not limited to, devices used for clinical diagnosis and therapy, educational purposes, commerce and industry and devices used in the home such as television receivers and microwave ovens.
2. Radioactive materials of all types used largely for clinical, industrial and educational purposes.
3. Possible effect on the population and the environment from exposure by an actual or potential discharge of radioactive wastes from nuclear-fueled electric power generating plants and nuclear fuel reprocessing plants, the peaceful uses of nuclear explosives and radioactive material disposal activities.

It is necessary to estimate the number and growth potential of the various radiation sources in order to evaluate the present and anticipated magnitude of public health problems associated with the defined radiation source.

DATA COLLECTION

Users of by-product, source, and limited quantities of special nuclear material within a state can be located from licensing information available from AEC or an "Agreement State." Information relating to other sources of radiation including x-ray equipment and radium may be obtained from state health departments, professional organizations, industrial groups, manufacturers, and distributors. Educational institutions can supply data regarding research equipment such as particle accelerators, electron microscopes, lasers, etc. Various state agencies can provide information on power reactors, mining and processing of source material, and waste disposal sites. For reasons of planning and development, radiation sources should be categorized by type of use and a method devised to indicate the number and location of such sources. In defining the problem, there may be more than one element. For example, in a medical and dental x-ray program (1) facilities and equipment should not cause unnecessary exposure, (2) techniques for using equipment should emphasize obtaining optimum clinical results with minimum radiation exposure of patient and operator, and (3) judgments regarding need for specific x-ray examinations or treatments should be made with appropriate consideration of the potential hazards of radiation exposure as well as of the clinical indications of the procedure. Thus, in developing objectives and the plan of action, there may be several lines of approach to remedy the situation.

OBJECTIVES

The establishment of objectives is directly related to the problems defined by the program. The various statistics noted in defining the problem must be interpreted in terms of the anticipated impact on the health status of the people. Develop priorities on the basis of health and aim at those areas which have the greatest potential for a health hazard. Measurable goals, based on these priorities can be established in terms of: (1) percent of facilities inspected, (2) percent of deficiencies corrected, (3) percent reaching compliance, and (4) desired user training level reached. Specific objectives and priorities vary among agencies, depending on a variety of political, economic, administrative and technical reasons. Ingredients necessary to achieve stated objectives include authority, standards, budget, personnel, organization and equipment.

Clinical use of x-ray is the largest source of man-made ionizing radiation exposure to the American public; this area requires top priority. The mission is to minimize exposure of patient and operators consistent with clinical requirements. Objectives in keeping with this mission include: (1) determining number of existing x-ray facilities and equipment not meeting acceptable standards, (2) correcting deficiencies, (3) determining the degree of compliance, and (4) determining what user qualifications or educational programs are required to reach a desired training level. Additional objectives include: (1) assurance that all facilities and equipment will meet acceptable standards and (2) development of qualification requirements for x-ray users.

The prime objectives of environmental surveillance programs for nuclear facilities and operations are: (1) to verify the adequacy of source control, (2) to provide data to estimate population exposure, and (3) to provide a source of data for public information.

PLAN OF ACTION AND IMPLEMENTATION

A plan should provide for accomplishment of objectives by effective use of resources. Existing constraints require identification. Principal constraints noted with respect to state and local radiation control programs include:

1. Lack of adequate funds and manpower to maintain comprehensive radiation control efforts. The most pressing need is for funds and manpower to provide effective control of electronic product radiation hazards at the user's level—especially in the area of diagnostic x-ray.
2. Insufficient staff and lack of suitable instrumentation to conduct control programs in non-ionizing radiation.
3. Considerable variation among state regulations in implementing radiation control authority. There is either a lack of regulations or a failure to update regulations.
4. Lack of authority to control sources of non-ionizing radiation such as lasers and microwaves and provision to license, certify, or set qualifications for users of x-ray machines in the healing arts.
5. Lack of quantitative data on biological effects and the public health significance of radiation received at low exposure rates.

PROGRAM ACTIVITIES

A basic plan includes functions and alternatives, the variety and scale of which is dependent upon existing radiation control authority and program resources. The following are examples for the program plan of action:

1. *Electronic Products and Radioactive Materials.* The initial step data collection, including number, type, and location of radiation sources; workload, and facility characteristics. Radiation-producing machines are registered and re-registered, usually every two or three years. Radioactive materials (except for small quantities or low concentrations that are exempted from regulation, are licensed or registered. Registration is an after-the-fact reporting of the acquisition of a source, whereas licensing requires pre-evaluation and approval before a source may be acquired. Licensing implies official approval of the use of the source, whereas registration does not imply approval or disapproval. Next, surveys should be conducted to determine whether facilities and equipment meet acceptable standards. Surveys include, but are not limited to, radiation exposure measurements, facility evaluation (darkroom, shielding, source storage, ventilation), personnel monitoring, operating and emergency procedures, and training programs. One method is a voluntary approach of offering radiological health recommendations at the time of the survey. In a regulatory approach the surveys are oriented toward obtaining compliance; however, consultation and education must not be neglected. Alternatives may be self-certification and/or inspections by qualified experts. Resurveys and followup visits are necessary to determine the deficiencies corrected and degree of compliance with appropriate recommendations and/or requirements. The preparation and distribution of education material, preparation of seminars and training courses, and continued educational program evaluation are necessary to maintain safe radiological health practices.

2. *Environmental Surveillance.* The extent of surveillance required depends on nuclear facility location (population density, meteorology, and other environmental factors), design, use, power rat-

ing, and mode of discharging radioactive waste. Media to be sampled, frequency of sampling and types of analysis required depend upon the critical nuclides anticipated in normal discharges and their dispersion in the environment from a population exposure viewpoint. Those living in the vicinity of the nuclear facility constitute the critical exposure group and require identification.

Procurement of proper field and laboratory instrumentation to detect and measure radiation of environmental concern is necessary. In designing an enviromental surveillance program, it is important that measurements and data be obtained through a pre-operational survey of the most sensitive vectors (surface and/or ground water, bottom sediments, air, milk, aquatic biota, food crops and other vegetation, soil, etc.). This information provides base-line data on environmental transport of radioactivity for (1) early indication of any increase in the amount of radioactive material released to the environment, (2) demonstration of the feasibility of the surveillance system for providing useful data, (3) including sensitivity & suitability of detection equipment, training and experience for personnel conducting the survey, and (4) public information. Selection of the sampling locations and frequency of sampling air, water, food, and agriculture products in the vicinity of the nuclear facility should be on the same basis as planned for the operational phase. Preoccupational surveys are usually conducted for a period of one year prior to the initial start-up of a nuclear installation. The data gathered by the environmental surveillance system during operation must provide the basis for source control and estimation of population dose. Because air and water are pathways through which radioactive contaminants are carried to other segments of the environment, analysis of radioactivity in these vectors is a basic requirement in the establishment of a surveillance program.

COORDINATION WITH OTHER AGENCIES

When developing a plan of action, consideration should be given to cooperative arrangements with other state programs or agencies. Some examples are:

1. *Occupational Health.* Most state radiological health programs began as part of existing occupational health programs. As programs developed, separate radiological health units were created at division or bureau levels. Frequently, radiological laboratory services are provided by a central laboratory unit in the department. Hazard evaluation of industrial applications of radiation (industrial radiography, x-ray diffraction, lasers, and particle accelerators) can be coordinated to improve the protection of the health of the worker.
2. *Dental Health.* This program provides technical support in conducting dental radiation surveys and preparing educational brochures and pamphlets on radiation for dentists and dental technicians. The program assists in keeping registration lists current by providing the radiological health program with mailing lists on dentists recently licensed to practice in the state or dentists who relocate their equipment.
3. *State Department of Labor.* In two states the relationship is spelled out by statute on promulgation and enforcement of regulations. In either, cooperative arrangements are developed for studying public health significance of radiation to mine workers and the public. In addition, the State Department of Labor or Workmen's Compensation Commission refers reports or claims for compensation to the radiological health program for investigation.
4. *Others.* Federal, State and local agencies responsible for water supply and pollution control, agriculture, census and conservation can assist in information and data collection for environmental surveillance. In addition, State and local programs responsible for water supply

will have mutual interest in radioactivity in drinking water and radioactive discharges into surface and ground water. State Highway, Highway Patrol, and Civil Defense Departments can provide assistance in responding to transportation accidents involving radioactive materials. State and local food sanitation programs can assist in locating microwave ovens used in commercial and institutional areas.

IMPLEMENTATION

The program plan and alternatives are based on the identified problems and established objectives. The implementation and scope of the program plan is dependent upon program resources and their effective use. The principal ingredients of a program are:

1. *Organization.* Ideally, on any one level of government, all radiation control activities should be located in one agency. The dominant concern is public health and the "public health approach" is likely to be most effective in the state health department. In some cases, other state agencies and local health departments have capabilities and legitimate concerns and should be involved. Regulations, forms, records, quality of personnel, and basic approach should be uniform statewide. Major program areas should be organized consistent with the plan. Major program areas include licensing, inspection, compliance, laboratory support, and surveillance. An advisory committee can be established to assist with program planning and development. Membership can include those associated with the healing arts, dentistry, industry, law, and other professions involved with radiological health action. The advisory committee could develop working subcommittees to assist with securing legislation, planning and drafting regulations, holding public hearings, and providing technical support.
2. *Legislation and Regulations.* There should be statutory authority for a radiological health program. The agency may need enabling legislation including authority to enter into interstate and federal-state agreements. Local agencies can adopt legislation compatible with state legislation or possibly use existing general health authority. Legislation should include authority for licensing and inspection of radioactive material not included under the Atomic Energy Act of 1954, as amended, and also contain provisions for reciprocity between various states. Comprehensive legislation should be developed to cover all types of radiation as defined in Public Law 90-602, "Radiation Control for Health and Safety Act of 1968." State and local programs need to develop and maintain regulations compatible with each other and with the federal program. For compatibility, the Council of State Governments' "Suggested State Regulations for Control of Radiation" can be used. Non-ionizing radiation regulations should be developed as the "state of the art" develops. One method is for state and local agencies to develop regulations as the Public Law 90–602 performance standards are published in the Federal Register.
3. *Personnel.* The program should base qualifications for all personnel on merit system classifications, establish job descriptions, and provide for career development. There should be requirements for a director, x-ray and radioactive material specialists, radiochemists, and environmental specialists. The director should be technically competent in all phases of radiological health, possess administrative experience, and have a degree in either physical or natural science or engineering. Salary differentials, advancement potential, and training opportunities should be considered when developing job descriptions in order to minimize personnel turnover. Some guidelines to determine manpower requirements are:
   a. *X-ray Control Program.* Inspection personnel include qualified college

graduates and/or technicians with a minimum of formal 2-year training in x-ray technology or in radiation control and provide a minimum technical effort of one man-year per 1,000 machines in the healing arts. This guideline is based on assuming a re-inspection schedule of five years, with 20 percent of all registered machines subject to re-inspection each year, and one person performing each inspection. A minimum of one man-year per 100 installations (nonmedical) is reasonable, assuming one person conducts an annual inspection of each installation.

b. *Radioactive Materials.* Inspection personnel include qualified college graduates and/or technicians with a minimum of two years radiological or related experience. A minimum of not less than one man-year per each 125 licenses should be provided.

c. *Environmental Surveillance.* The individual who plans the program should have experience in ecology, radiological health, or similar experience. It is desirable to have an experienced radiochemist prepare and analyze the samples.

d. *Non-ionizing Radiation.* There should be a minimum of one man-year per 1,000 sources and the individual should have specialized training with lasers, microwaves, diathermy, etc.

4. *Training.* Frequently, trained personnel for radiation protection are not available and it is necessary to train individuals with other academic backgrounds in radiological health. There are several short courses presented by PHS and AEC. These are specialized technical courses covering basic radiological health, fundamentals of non-ionizing radiation, particle accelerators, industrial radiography, and environmental surveillance. The program should have a continuing training program consisting of seminars, demonstrations, lectures, and short- and long-term training to keep personnel abreast of current developments in the field.

5. *Fiscal Support.* By far the largest problem encountered by the states is insufficient funds to maintain an adequate staff and necessary instrumentation. The program should not be spread too thinly because of funding limitations. Qualitatively and quantitatively, the largest area of unmet radiological health needs is in the clinical applications of radiation. This area should receive first priority for fund allotment. Expenditures for radiation control vary greatly among the states. The average expenditure of the states for radiation control was 3.6 cents per capita for Fiscal Year 1969. Agreement states are more successful in obtaining additional funds for radiation control programs than are non-Agreement States. The minimum budget summary should estimate the anticipated line item expenditures for personnel service, technical equipment, operational costs, training and supporting services showing federal, state and local participation.

6. *Instrumentation.* The acquisition of basic survey instrumentation for field surveys and laboratory services for radio-assay work is essential. This represents considerable initial outlay with maintenance costs as a recurring budget item. Specific equipment guidelines are:

a. *X-ray Control Program.* For each surveyor a minimal survey kit contains an integrating ionization chamber, ionization rate meter, and glow bars.

b. *Radioactive Materials.* Each surveyor should have portable GM and ionization chamber instruments. There also should be capability for field measurements of alpha and neutron radiation, but it may not be practicable for each surveyor to be equipped for such measurements.

c. *Environmental Surveillance.* Essentials include air samplers, a low background beta counter, a multichannel analyzer with appropriate sample shield, and a capability for measuring alpha radiation. In addition, equipment and supplies for sample preparation are necessary.

d. *Non-ionizing Radiation.* The types of instruments required may include: (1) a microwave power density survey meter, (2) a laser detector, (3) an ultraviolet and visible light detector, (4) a sound level meter, (5) an RF meter, and any other instruments that may be needed for special measurements.

For all instrumentation, there should be a system for calibration and servicing of each radiation detection instrument on a planned schedule.

7. *Records.* Collection and assessment of information on radiation hazards is basic to an effective program. Preventive capability of any radiological health program directly depends on its ability to estimate distribution and magnitude of population exposure and to identify potential sources which may be released to the environment. Without well-designed procedures and facilities for collection and assessment of data, it is impossible to establish realistic priorities for assignment of available resources to develop and initiate preventive measures. Regulatory records include registration and/or licensing for all radiation sources, survey forms containing minimum uniform inspection data, compliance and enforcement actions and records of sales and transfers of radiation sources. Exposure assessment records include personnel monitoring records for radiation control employees, surveillance data and reports of incidents and investigations.

EVALUATION

Evaluation provides a method for the program to measure the effectiveness of its efforts to achieve, improve, or maintain a health environment. There is no precise method of evaluating the effectiveness of a radiological health program by such indices as reduction in genetic mutation rate, incidence of leukemia, human mortality, or life-shortening effects. These effects are not apparent for many years, even generations, after implementation of radiation protection measures. Instead, program progress is evaluated by determining the extent of completion of specific objectives of the program. Program evaluation includes determining the degree of compliance with the recommendations and requirements of the agency and improvements made to reduce, if not eliminate, unnecessary radiation exposure. In order to suggest an approach for evaluation, several segments of the total radiological health program can be considered.

1. *X-ray Control Program.* There is a substantial component of *unnecessary* radiation exposure associated with the use of medical and dental x-ray. Improvement is possible, and effectiveness may be measured by the degree of improvement achieved. By increasing the number and percentage of x-ray machines meeting minimal standards one can obtain a decreased annual, genetically significant dose from exposure to medical and dental x-rays. Another approach is to increase the number of qualified radiation users through education and training programs and thus, hopefully, improve users' x-ray techniques.

2. *Radioactive Materials.* Radium has been in use many years, largely unregulated. There have been many incidents of leaking and lost sources and contaminated facilities. These deficiencies are due to inadequate technical and administrative controls by some users. Effectiveness can be evaluated by insuring that standards of radium management are upgraded to equivalence with standards for AEC controlled radioactive materials.

There is a lack of adequate nationwide control of the hazards to health from accelerator produced radioactive materials. There is a lack of uniformity in such control measures as safety standards, inspection requirements, and enforcement provisions. Program effectiveness can be measured by obtaining and implementing a radiation safety program for all radioactive materials not controlled by the AEC.

3. *Environmental Surveillance.* The control of radioactive effluents from nuclear industry has been excellent. Effectiveness of state and local programs must be judged largely on the degree of assurance that present safeguards are maintained. The state radiological health program must take an active role in public relations. The general public should be informed on the environmental surveillance program around nuclear facilities and the public health significance of routine radioactive discharges. In the area of environmental surveillance, it is difficult to measure effectiveness. Basically, programs and plans are judged reasonable and adequate by persons compentent in this field.

Program evaluation must go on continuously; however, planned, formal periodic reviews are also recommended. These reviews should be held at least annually and preferably on a quarterly or semiannual basis, depending on the speed of program development. It should be borne in mind that, in any organization, many programs are competing for funds and it will be necessary to demonstrate progress on a strictly dollars and cents basis or the program may be eliminated or sharply reduced. Program evaluation will locate existing shortcomings, or a former radiation hazard may no longer exist. This will require a redefinition of goals and objectives and the development of new priorities. A program, properly planned, should be able to demonstrate directly or indirectly an improvement in public health.

Program evaluation assistance is available from the Conference of Radiation Control Program Directors, the Bureau of Radiological Health, and for Agreement States, the Atomic Energy Commission.

NOISE

INTRODUCTION

The concern of public health officials in enhancing the quality of life necessarily includes a consideration of noise and how its deleterious effects on man can be prevented or minimized. Particularly since the 1940's, noise has concerned an increasing number of scientists, physicians, architects, manufacturers, and civic authorities. It is no longer a discretionary, but a mandatory responsibility of the community health officer to combat noise pollution.

Consideration of noise and its effect comes far too often only as an afterthought in community planning. Any planning for the reduction of noise levels requires a review of the various effects of excessive noise exposure that are already known and an investigation of the preventive measures which are available and could be taken to avoid excessive and unwanted sound exposure. Researchers concerned with noise problems have directed their attention mainly to the question of hearing loss resulting from intense industrial and military noise. Very little is known about the integrated response of man to community noise—what noises man encounters in his community-home environment and how he reacts to them.

Table I cites overall sound levels for various sources of noise encountered in different environmental situations. Such noise levels are expressed as decibels measured on the A-network of a sound level meter, abbreviated as dBA. Noise readings in dBA are weighted measures approximating the human ear's sensitivity to different sound frequencies when heard at moderate intensities.

Table I shows that noises in mechanized industries, as a group, have higher, more intense levels than those found outdoors in a community or indoors in a home. Furthermore, it is likely that in industrial operations there can be, and is, more sustained exposure to various types of high noise levels during the typical 8-hour workday. Nonetheless, certain noises intruding in community or home environments can reach levels comparable to those noted for the noisier workplaces. Residents living under the flight paths of a nearby airport or those who frequent discotheques may experience the same noise levels as produced in riveting operations or around textile looms. A home powermower produces the same noise levels as a farm tractor or newspaper press. The noise of a food blender may even slightly exceed that noted in a milling machine workplace.

CURRENT STATUS OF CONTROL PROGRAMS

Current efforts to control environmental noise problems and alleviate their adverse effects have had only partial success as exemplified by the following:

1. Standards committee and other technical groups seeking to establish uniform procedures for rating noise conditions and for specifying criterion exposure levels for minimizing certain adverse effects are still unable to resolve outstanding differences. Variance in opinions regarding the design goals for criteria, differences in schemes for measurement, and lack of sufficient data regarding the harmful and disturbing effects of certain types of noise exposure hamper agreements. Nevertheless, a number of proposals bearing on criteria for hearing conservation in noise and on schemes for predicting noise annoyance have been generated, some of which are serving as interim guides in industrial and community noise control efforts.

2. While federal and state laws have been passed to control environmental noise problems, there aren't enough persons properly qualified or sufficient equipment on hand to make the necessary noise checks for enforcement purposes. For example, there are 75,000 plant locations covered by the Walsh-

Preceding page blank

TABLE I
'A' WEIGHTED SOUND LEVELS OF SOME NOISES FOUND IN DIFFERENT ENVIRONMENTS

OVERALL LEVEL dBA (SPL re 0.0002 MICROBAR)	INDUSTRIAL (& MILITARY)	COMMUNITY (OR OUTDOOR)	HOME (OR INDOOR)
—130—	ARMORED PERSONNEL CARRIER (123 dB)		
UNCOMFORTABLY	OXYGEN TORCH (121 dB)		
—120—LOUD	SCRAPER-LOADER (117 dB)		
	COMPACTOR (116 dB)		ROCK-N-ROLL BAND (108–114 dB)
—110—	RIVETING MACHINE (110 dB)		
	TEXTILE LOOM (106 dB)	JET FLYOVER @ 1000 FT. (103 dB)	
—100—VERY	ELECTRIC FURNACE AREA (100 dB)	POWER MOWER (96 dB)	
LOUD	FARM TRACTOR (98 dB)	COMPRESSOR @ 20 FT. (94 dB)	INSIDE SUBWAY CAR—35 MPH (95 dB)
— 90—	NEWSPAPER PRESS (97 dB)	ROCK DRILL @ 100 FT. (92 dB)	COCKPIT-LIGHT AIRCRAFT (90 dB)
	COCKPIT-PROP AIRCRAFT (88 dB)	MOTORCYCLES @ 25 FT. (90 dB)	FOOD BLENDER (88 dB)
— 80—	MILLING MACHINE (85 dB)	PROPELLER AIRCRAFT FLYOVER @ 1000 FT. (88 dBA)	GARBAGE DISPOSAL (80 dB)
MODERATELY	COTTON SPINNING (83 dB)		CLOTHES WASHER (78 dB)
— 70—LOUD	LATHE (81 dB)	DIESEL TRUCK, 40 MPH @ 50 FT. (84 dB)	LIVING ROOM MUSIC (76 dB)
	TABULATING (80 dB)		DISHWASHER (75 dB)
— 60—		DIESEL TRAIN, 40–50 MPH @ 100 FT. (83 dB)	TV-AUDIO (70 dB)
			VACUUM (70 dB)
— 50—QUIET		PASSENGER CAR, 65 MPH @ 25 FT. (77 dB)	CONVERSATION (60 dB)
— 40—		NEAR FREEWAY-AUTO TRAFFIC (64 dB)	
		AIR CONDITIONING UNIT @ 20 FT. (60 dB)	
— 30—VERY QUIET		LARGE TRANSFORMER @ 200 FT. (53 dB)	
		LIGHT TRAFFIC @ 100 FT. (50 dB)	
— 20—			
JUST			
— 10—AUDIBLE			
— 0—THRESHOLD OF HEARING (1000—4000 Hz)			

NOTE: UNLESS OTHERWISE SPECIFIED, LISTED SOUND LEVELS ARE MEASURED AT TYPICAL OPERATOR-LISTENER DISTANCES FROM SOURCE.

Healey Public Contracts Act which now includes a noise rule limiting exposure conditions at the workplace. The Depart-of Labor admits that its present force of inspectors can reach only 5% of the contract plant locations in any given year. In addition to this shortage, there aren't enough competent acoustic engineers or noise control practitioners available to solve the innumerable problems that exist or can be anticipated in reducing workplace noise as well as community noise to safe and acceptable levels. There are less than 5 universities at the present time that offer a degree or program in noise control engineering or applied acoustics. On the brighter side, there are numerous one-two week courses available for presenting fundamentals regarding recognition, evaluation, and control of noise problems.

3. In some instances, federal efforts to curb real or potential noise problems have been nullified by local private interests. For example, the FHA recently refused to finance the construction of a high-rise complex near an airport owing to potential aircraft noise intrusion problems. A local bank picked-up the mortgage on this project and therein vitiated a preventive approach at noise control.

4. Zoning plans stressing compatible land-use in areas bordering airports, roadways, and factory areas are not being established or complied with. Residential construction is underway in areas neighboring major U. S. airports where projected aircraft operations for 1975 give every indication of severe noise intrusion problems.

5. Civic groups have had some success in bringing the attention of public officials to some obvious noise control needs. The efforts of organizations such as Citizens' for a Quieter City have resulted in the quieting of construction-demolition operations and in reducing noise in garbage trucks and even garbage cans. Surprisingly, however, one noise target overlooked by such groups is the citizen noisemaker. That is, the individual who honks his horn incessantly, who plays his radio for the neighborhood to hear, or who holds loud parties lasting to the early morning hours. Best noise attenuation measures here are attritudinal ones; that is, considerateness of others or just plain courtesy. One should not underestimate the benefit that may be gained from curbing such noisemaking behavior. Largely through vigorous campaigns directed against unnecessary horn blowing, Memphis earned the title of the quietest city in America.

6. Development of quieter industrial processes using assorted techniques (of muffling, baffling, substitution of nonmetallic parts, etc.) continues, spurred by equipment purchases which may include noise limiting requirements in their specifications. Development of quieter aircraft engines is progressing as is the study of take-off and landing procedures which offer noise reduction in the airport region. Retro-fitting existing engines in jet fleets to achieve noise reduction involves great expense and for this reason is opposed by members of the air transport industry who would rather put their quieting efforts into new aircraft. Of concern also are anticipated heavier air traffic loads which may nullify any noise reduction due to flight procedure modifications.

PROBLEM

Fortunately, these more significant sources of community and home noise occur intermittently and perhaps infrequently, which reduces the overall severity of the exposure. On the other hand, some non-occupational exposures, while intermittent, may occur over longer daily periods than the usual 8-hour workday. Indeed, neighbors of major airports and busy expressways may experience intermittent noises on a round-the-clock basis. Moreover, key sources of community noise, such as those caused by transportation systems, may have wide areas of impact and affect sizable populations. Present indications are, for example, that the supersonic transport, if permitted to fly supersonically across the USA, could produce sonic boom corridors fifty miles wide that would impact from 35 to 60 million person per transcontinental crossing.

Even without the SST booms, 130 million persons are living in urban areas throughout the U. S. which are becoming steadily noisier due to increasing crowding and traffic congestion, construction activity, and wide-scale manufacturing. Suburban areas have not been spared either. A survey of these residential areas in 1967 revealed noise levels that were from 4 to 7 decibels greater than those noted 13 years earlier. Even more striking, the maximum levels intruding into communities in 1967 were as much as 18 decibels greater than those found before. An increase of 3 decibels is equivalent to a doubling of energy affecting some areas in which people in the United States live has increased as much as 64 times in a 13-year period.

EFFECTS OF ENVIRONMENTAL NOISE ON MAN

The environmental noise levels and exposures just noted can adversely affect man in various ways. Most notable effects include: 1. Temporary and permanent hearing loss. 2. Physical and mental disturbances. 3. Interference with voice communication. 4. Disruption in job performance. 5. Disruption of rest, relaxation, and sleep.

These noise-induced effects deserve elaboration in the context of industrial and community/home exposures.

Noise-induced hearing loss is believed to be the most serious physical health hazard posed by excessive noise, and such problems are prevalent in mechanized industry. Surveys in a cross-section of manufacturing, construction, mining, farming, and other occupations have found noise levels potentially harmful to hearing, and hearing studies on some select worker groups have shown the workers to have poorer hearing than those in quieter jobs (office workers). Estimates of the total number of production-line workers experiencing noise conditions hazardous to their health range from 6,000,000 to 17,000,000. The true figure is unknown.

Recognition of noise and hearing loss problems in industry has prompted the passage of regulations to curb this health hazard.

The criteria for noise limits contained in these regulations, however, still lack wide acceptance among noise experts who believe that more information will be needed to justify limits prescribed for certain types of industrial noise conditions. The U. S. Public Health Service is one of several groups conducting field and laboratory research to provide documentation of hearing conservation criteria for a wide array of possible occupational noise exposures.

Community and home noise exposures, owing to their generally less severe nature, do not pose the same hazard of noise-induced hearing loss as is the case in industry. Yet, it is now contended that exposures to the aggregate of noises characterizing life in a modern society—noises from mass transportation, arrays of household appliances, power tools, and hobbies and recreational activities—can cause some degree of hearing loss aside from that due to the work environment. Such a loss is termed "sociocusis," which is to be differentiated from the hearing changes due purely to advancing age, called "presbycusis." One example of sociocusis may be occurring among teen-age musicians who play rock-and-roll music. There is some evidence of hearing loss at high frequencies for these musicians due to their more frequent exposures to high level sounds. One investigator, in screening the hearing of high school and college freshmen, noted an increasing incidence of high frequency hearing loss in these student groups. He believes these losses to be due to high level noise exposures in recreational activities. Also, some residents living close to an airport and subject to the noise from frequent engine ground run-up operations on jet aircraft are showing high frequency losses. It has been suggested that such changes are due to this community noise exposure.

Needless to say, these sociocusis findings can greatly complicate judgments of occupational noise-induced hearing loss and more generally pose difficult problems in defining "normal" hearing.

Presently, there is much conjecture as to whether excessive noise conditions can cause physical or mental health disorders. That noise can trigger changes in cardiovascular endocrine, neurologic, and other physiologic functions, with correlated feelings of distress, is readily demonstrated. At issue is whether repeated noise-induced changes of this nature ultimately result in a disease process.

Many noise experts believe that man's tolerance to noise is quite high and that more environmental noise conditions can be adapted to without ill effects. Yet, there are others who maintain that the stressful effects of noise, alone or together with other stress factors, can eventually overwhelm man's capability for healthy adjustment with resultant physical or mental health problems.

Scattered evidence for both points of view exist, but in point of fact crucial, systematic studies remain to be done in this problem area. For example, numerous studies on animals as well as humans have found physiologic changes initially induced by noise to subside with repeated or prolonged exposure to the same sound. This suggests adaption and presumably no health problem. These studies, however, have not been conducted over sufficiently long time periods to judge the possible long-term costs of this adaption to the health of the organism. In this regard, physiologic irregularities of a cardiovascular and neurologic nature have been reported in the foreign literature for workers exposed many years to high level industrial noise. Also noted in these studies is an increase in irritability and social problems among the workers, both at the job as well as in their home situations.

These results conflict, however, with other investigations involving human exposure to high level noise in the military. No unusual physical or psychiatric disturbances were found in aircraft carrier deck personnel subjected to extremely intense noise for concentrated operational periods. Reasons for the discrepant nature of these findings are not obvious. Perhaps military personnel, representing a select and conditioned group, are better able to cope with a noxious noise environment. This, of course, raises the issue of the possible stressful effects of noise on persons whose physical and mental health is already impaired. Would, for example, better noise exclusion in hospital wards hasten recovery time in the sick? A recently published study found patients' requests for pain-relieving medication in a surgery recovery room to rise coincident with increased noise levels straying into this area.

Hypertension, undue nervousness, and assorted mental difficulties have been claimed by some residents living in communities subjected to intense aircraft and highway noise. These claims have not been sufficiently investigated to ascertain their validity. Indeed, only two cursory-type evaluations have been made, yielding conflicting results. In one, an inquiry of doctors having offices in the vicinity of London Airport revealed only one patient being treated for a mental disturbance attributed by the physician to aircraft noise exposure. A check of pharmacies in the same neighborhoods found no above-normal use of tranquilizers or drugs which might have reflected the stress of the aircraft noise disturbance. A more recent preliminary report from the same airport region has found the number of admissions to a mental hospital from a residential zone receiving intense aircraft noise to be significantly more than from a comparable demographic area not so exposed.

Clearly, the incomplete, inconsistent nature of the evidence summarized above underscores the need for comprehensive study of possible acute and chronic health effects that may be caused by long-term cumulative noise exposures on both general and special populations. One can envision investigations where the health status of groups experiencing known levels of noise will be monitored for periods of 10 or more years in order to fully evaluate this problem. Such work will be expensive, obviously time consuming, and fraught with confounding factors. Nevertheless, resolution of the issue of physical and mental health problems posed by environmental noise will require this type of effort.

Noise not intense enough to cause hearing damage or other physiologic effects may still disrupt speech communication as well as the hearing of other desired sounds. In industry, this disruption can degrade efficiency on jobs requiring reliable communication by voice. Much is known about the masking effects of noise on speech and recommended noise limits for offices are based on these masking considerations. Inability to hear warning signals or shouts of caution in other workspaces because of high level noise can also be implicated as a factor in industrial accidents, but data to indicate the significance of this problem are not available.

Annoyance reactions to noise intruding in communities also have arisen from interferences with talking and listening activities. Schools neighboring busy airports and roadways have experienced severe disturbances of this nature and in some cases have had to close down. Measures of the masking effects of noise on speech are now being considered as a basis for establishing permissible outdoor noise limits in city noise ordinances.

The effects of noise on performing tasks for which voice communication is not necessary are quite variable and depend greatly on the nature of the noise conditions present, the task being performed, and the attitude of the worker. The most consistent laboratory evidence for noise-performance loss has been shown for those tasks requiring complete and unremitting attention. Consistent with these laboratory findings, work on jobs involving vigilance activities, such as monitoring machines and quality control inspection, show improvement with the introduction of noise control. Data coupling industrial noise conditions with accident rates, absenteeism, and employee turnover are not available. Noise may be implicated in these occupational problems, but causal relationships may be difficult to demonstrate. Also, the build-up of fatigue in a noisy job situation and its possible carryover to subsequent off-job activities, e.g., auto accidents in returning to one's home, have not been studied.

Noise effects on tasks of concentration would appear an unimportant consideration in the community or home environments. However, the prospect of commercial SST flights and potential sonic booms in these situations raises the possibility of behavioral disturbance, perhaps automobile and home accidents, arising from the startle effects from this type of noise.

There is little doubt that noise can frustrate one's desire for privacy, rest, relaxation, and sleep. For example, questionnaire surveys of communities exposed to intense aircraft flyover noise have found interruption of rest, relaxation, and sleep to be one of the major causes of annoyance and compliants. Moreover, more people voice complaints about noise when they are indoors at home than when they are outdoors or at work. Presumably, needs for peace and quiet are greater at home, which makes the disturbing effects of noise in the home more potent.

Presently, there is interest in developing annoyance criteria for noise based on its disturbance to sleep. Various considerations dictate this type of criterion development. Field studies have shown greater annoyance results when sleep or rest are disturbed by noise then when other activities, e.g., listening are similarly interrupted. Rest and sleep presumably provide the conditions for restitution of body energy and recovery from fatigue and thus may have health significance. Disruption of sleep by noise also offers a more objective method for gauging annoyance than other procedures using subjective ratings of acceptability.

Identification of noise or sound levels capable of disrupting sleep is going to be difficult. The amount of noise needed to awaken a slumberer varies for different stages of sleep. The degree of familiarity or meaningfulness of the noise also has a significant effect on its disturbing quality. Common experiences have shown, for example, that the city dweller, frequently encountering high levels of outdoor and indoor noises becomes accustomed to the sounds and can sleep in their presence. The same person vacationing in the relative quiet of the country finds it difficult to sleep because of the cricket noises.

Still another question that has to be answered in setting noise criteria for sleep is whether the noise may adversely affect the sleeper even though he is not consciously awakened. One sleep researcher believes that noise can interfere with the dream process during sleep without causing conscious awakening and that recurrent interventions of this sort cause greater irritability, tiredness, and difficulty in concentrating during the awake hours.

Work presently being supervised by the Public Health Service indicates that noise disturbances to sleep patterns, either causing awakening or shifts in sleep stage without awakening, when occurring over a succession of nights can alter mood and performance measures taken each day following noise-sleep sessions.

In addition to evaluating noise effects on sleep, great efforts are being made to determine an acoustic scale that can best quantify noise annoyance and provide limits for tolerable exposures. Various scales have been recommended for this purpose including perceived noise level in units of PNdB, A-scale levels in dBA, loudness levels in sones or phons. Limits expressed in these measures and units have been adopted into noise control regulations. For example, JFK Airport has a 112 PNdB ceiling on aircraft take-off operations measured at the airport boundary. California, New York, and Connecticut have placed limits of 82-88 dBA on noises emitted by vehicles on state roads.

While such limits are essential to noise control, one should remember that many sounds are judged not because of their acoustic properties, but because of psycho-social considerations. For example, some sounds are judged annoying because they convey stress, alarm or have other unpleasant meanings. A survey of noise conditions in hospitals found that most prevalent source of annoyance to be staff conversations in the halls. These sounds were not objectionable because of their loudness, but because of the information communicated, namely, descriptions of patients' symtoms, forthcoming operations, prognosis. To cite another case, the sound of approaching aircraft can elicit fear, owing to a crash possibility, and such fears appear to motivate complaints about aircraft noise in neighborhoods near airports. Similarly, the screaming sirens of a patrol car, a clanging fire engine, because of the purposes attached to them, can engender annoyance out of fear.

These unpleasant associations, together with still other social psychological factors such as—percieved necessity attached to a noise source—time of day where a given noise is heard—the listener's conditioning to noise) hopelessly complicate the development of any acoustic scale for depicting noise annoyance. Such considerations also make it clear that there are no practical means for freeing everyone from annoyance problems caused by noise.

OBJECTIVES

Noise control objectives may be directed toward abatement of noise sources rather than impact on human health. Possible objectives for a state or local noise control program may include:

1. Reduce by X% the current work force exposed to excessive industrial noise by 19 . . .
2. Through continuing surveillance, detect increases in noise sources and take timely countermeasures so as to prevent any increase in urban noise levels during the next X years.

Steps for meeting such objectives might include:

1. Develop a noise-source inventory of all principal sources within urban areas by 19. . .
2. Develop and obtain the adoption of noise control standards within one year.
3. Obtain necessary laboratory and field equipment to monitor and identify noise sources within X years.
4. Conduct X (number) of orientation training courses for X (number) of local health and industrial personnel.

Priorities must be determined on an individual basis and will be governed by resources available for carrying on the functions, and by legislative and political mandates, policies of the department under which the noise program operates, and the emergency of new health hazards created by continuously changing technology.

PLAN OF ACTION

The important task for the state or local noise control agency is to point out to industry and government how to solve its own problems. The noise hygienist must be quite familiar with his community in order to recognize the existence of adverse health stresses. He must know the general effect of these stresses on man's health, and more important, he must know practical and economic ways to reduce or eliminate them. Moreover, he cannot work without the tools of the trade, including expensive instruments.

CONSTRAINTS

The lack of proper equipment is a constraint upon the program as are:

1. Lack of quantitative data on effects of noise on man, nature and extent of health hazards, and general health problems.
2. A serious shortage of manpower in the noise field including engineers, chemists, physicians, nurses, scientists, and technicians for work in official agencies and in private industry.
3. Lack of funds for carrying out programs at state and local levels.
4. Lack of uniform rules and regulations concerning noise safety and health, and a mechanism for implementing these rules and regulations at the state and local levels.

PROGRAM ACTIVITIES

Given reasonably adequate resources and freedom from constraints, the types of services which the noise control agency can provide, alone or in cooperation with other groups, are extensive and will depend upon the agency's resources and problems in the area. The following are examples of functions that can be included in a plan of action.

ENVIRONMENTAL SERVICES

A comprehensive program may include the following environmental services:

1. Basic to any plan is a noise profile of the locality.
2. A rapid or "walk through" survey of industries can be used to collect basic information on potential noise hazards and their control, availability of preventive health services to workers, and extent of safety activities. Frequently, advice on control of obvious hazards can be offered on the spot.
3. Once a state or local program has been established, a system of routine and periodic surveys must be established to identify hazards and plan for their control.
4. Follow-up visits or resurveys are necessary to determine compliance with recommendations made for improvement or control of hazards.
5. Professional investigation of reported or suspected noise injuries with recommendations for elimination or control of causative agents can prevent their recurrence.
6. Consultative services on prevention and control of noise exposures should be offered to employers, physicians, nurses, contractors, and others.
7. Review and examination of engineering plans can insure installation of proper environmental controls.
8. Preparation and distribution of information sheets and health education materials are additional types of assistance to employers and workers.
9. In the interest of eliminating duplication or overlapping of services, cooperative working relationships should be established and maintained with other official agencies such as the State Occupational Health program.
10. Writing of needed or improved regulations governing noise control or providing assistance to the agency authorized to promulgate such rules and regulations should be routine functions of the program.

MEDICAL AND NURSING SERVICES

A well-rounded state or local official noise program also includes medical and nursing components. The prime purpose is to assure the involvement and commitment of civic groups in noise control services.

THE FINAL PLAN

The major combinations of mixes of activities which could comprise alternative plans for the noise program are determined in light of the identified problems and the established objectives and priorities.

These alternative plans must be then examined in terms of their relative potential effectiveness, the resources likely to be available, public acceptability, and other contraints. The alternative which appears to be the most effective that is also feasible of attainment is recommended for final action. If approved, this action plan then defines the content of the program to be implemented and sets the resource requirements.

IMPLEMENTATION

The carrying out of a plan of action must be done within the context of situations that will vary by states or other political entities. So long as the basic elements are put together in workable fashion, the final pattern of implementation may vary in a good occupational health program. These basic elements are organization, personnel, training, budget and legislation.

EVALUATION

If the evaluation of a noise program is to be meaningful, it must be closely tied to the objectives of the program. It must indicate the progress—or lack of progress—being made by the program toward the achievement of its objectives. A meaningful evaluation would indicate the appropriateness, adequacy, effectiveness, and efficiency of programs as measured against stated objectives. Thus, an objective may be stated in terms of reduction in dust or other contaminant levels in given work situations. The objective has been met if the levels were in fact reduced.

In a noise program the Plan of Action may include certain activities such as inspections, health services, or statistical reports of data. Some of these kinds of activities may be means for attaining the defined objective; others may relate to the program's objective in an evaluative or reportorial way. Obviously, there is a need for continuing vigilance to insure that such activities be carried out; in other words, there also needs to be evaluation of the means and tools being used to achieve objectives. Such evaluation, however, should not be confused with that of reduction of illness, or decrease in noise pollution.

VECTORS

INTRODUCTION

Vector control is an essential health program in every state, although magnitude and type of problems vary greatly because of climate, topography, and demography. Many arthropods and rodents are vectors of disease or cause injury to humans, but annoyance cannot be neglected, for it aggravates human misery. People who are the least able to provide a good environment for their families suffer most from arthropods and rodents that affect human health and well-being. People in all walks of life are subject to vector problems whether they live in substandard housing or affluent homes. Increased urbanization and mass exodus to the suburbs have caused new problems and aggravated old ones. Annoyance from mosquitoes, flies and other vectors results in limitation of use of recreation areas or backyards. It not only restricts enjoyment, but often affects the prosperity of a resort or other area. High mosquito populations keep the tourist away, as does the threat of disease. This was clearly illustrated when an epidemic of Eastern encephalitis occurred in 1959 in New Jersey and when St. Louis encephalitis struck the St. Petersburg-Tampa Bay area of Florida in 1962. Vector-borne diseases occur in every state. The potential for additional ones always exists, especially following natural disasters.

Environmental control of vectors, whether by source reduction, chemical, or physical means, is an activity which serves two purposes: (1) prevention of vector-borne disease, and (2) reduction of annoyance, thereby creating an environment which can be more fully enjoyed by everyone, at work, at home, and during recreation. Social and economic implications of vector control are especially important. The rat in the ghetto has become a symbol of the many ills of the high-density disadvantaged. Programs to reduce rats (which will at the same time reduce fly populations) rely largely on improvement of certain environmental conditions such as solid waste storage and general premises sanitation. This cannot be realized without effecting a change in the attitude and behaviour of the residents. These changes, as they occur, necessarily result in greater pride and self-respect, the fringe benefits of which include economic and aesthetic improvement in the community as a whole. Reduction to a negligible level of human exposure to arthropod vectors and pests requires various approaches and skills and the cooperation of the total community, urban, suburban, and rural.

CURRENT STATUS OF PROGRAMS

Federal Activities in vector control include all aspects of research including epidemiological studies, demonstrations, technical assistance in the form of training, consultation and evaluation, and grants for control programs. Research is carried out by a number of agencies. U.S. Department of Defense investigations often yield findings applicable to conditions other than those existing in the military establishment. The U.S. Departments of Agriculture (USDA) and Interior (USDI) in their research and development undertakings produce new materials and techniques having broad vector control application. These departments also provide consultative and other services. For example, for a number of years USDA and the Georgia State Department of Health cooperated in a development-control operation applying pesticides to Jekyll Island for control of ticks. USDI has for many years directly assisted towns and rural areas in rat killing problems. Their current activities in rodent control are principally rural but their field representatives remain available for limited consultation to cities and smaller communities. The U.S. Department of Housing and Urban Development (HUD) provides grants for rat control programs in Model Cities areas. HUD also provides assistance to rat control under its concentrated housing code enforcement and redevelopment programs. These activities result in structural improvement of dwellings

Preceding page blank

reducing the possibility of rat access to the interiors. They also result in demolition of principal and accessory structures, which in many cases are rat harborages, replacing them with sound, new rat-resistant construction.

The principal vector-control programs of the federal government are located in the Public Health Service (PHS), U.S. Department of Health, Education and Welfare (HEW). PHS conducts and supports research, provides training, consultation, and evaluation services, and in the area of rat control, provides grants to conduct programs and demonstrations. Grants to states for broad environmental improvement under the Partnership for Health Legislation may be used in activities related to rat control. Also under that program, direct grants are being made to a limited number of cities and states for urban rat control projects. Such projects emphasize general environmental improvement, public information, and education as the principal methods for permanent reduction of rat populations. This is supplemented by judicious use of rodenticides, especially in the early years of program development. Environmental improvements have the fringe benefits of reducing sources of premises-breeding of mosquitoes and flies and generally improving appearance and livability of crowded urban areas. The PHS Solid Waste Program supports research and demonstrations which relate to rat and fly control. PHS water hygiene activities help limit development of new mosquito breeding areas.

State programs for vector control are usually vested in the health department but in some may be the responsibility of another state agency such as the department of agriculture or the state university. Many states have a history of outstanding accomplishments in vector control. In fact, some state and local health departments began as organizations set up to cope with disease problems associated with vectors. Often state activities in vector control are severely limited by budgetary constraints. Although some states have sophisticated programs, including research stations, many are able to support only minimal or token activities. Many states have passed laws directly or indirectly facilitating rodent control in the entire state, but more legislation is needed in some. Rodent-related legislation includes banning open dumps within state boundaries, permitting establishment and financing of local mosquito or other abatement districts, and laws relating to solid waste and water management. The most effective vector control programs are carried out in states that provide strong state leadership and support for local efforts, with maximum utilization of federal resources.

Local Programs are usually operational and depend upon state and national agencies and institutions to develop new methods and materials and provide guidance. Local programs for vector control vary in size and competency. Most need considerable strengthening. Activities in the various aspects of vector and pest control are carried out by one or more agencies such as local departments of health, public works, housing, or sanitation; or by abatement districts or other agencies. Some larger city health departments carry out rat control programs on a large scale. In at least one state, financial assistance to communities for vector control is available from the state health department. This has encouraged development of new programs to meet public demand. Federal funds from HEW, HUD, and the Office of Economic Opportunity have provided new community rat control programs and/or have strengthened existing programs.

The utilization of a new category of local program employees, the Vector-control Aide, Health Educator Aide, or Community Health Aide, has provided considerable assistance to the development of recent rat control projects. These workers, indigenous to program target areas, are recruited, trained and utilized in promoting public awareness and providing service to residents of the area through dissemination of information. This helps the people both to help themselves and to obtain help where the problem is beyond their jurisdiction. These health aides, who often are local homemakers, serve on a part- or full-time basis. They understand people in the "target areas" because they live there too. They communicate with the people and the knowledge derived from this communication is conveyed to supervisors, officials and planners who can then develop programs more sensitive to the needs and feelings of the people. Often these aides, although employed principally for the furtherance of a specific public health program—rat control—provide information, assistance and referrals to meet other health needs of the community.

Few local health departments have established comprehensive vector control programs. Vector control is accomplished on a complaint basis or as a part of routine environmental sanitation. Larger city health departments should have a formal vector control organization with a planned program designed to reduce arthropod and rodent populations to acceptable levels. In smaller health departments, a planned, organized program may be conducted without a large formal organization but with one or more sanitarians specializing in vector control. Local legislation is especially important in vector control. Banning of open burning in many communities has virtually eliminated the burning of solid wastes which had provided a residue of "toasted" organic matter, tasty food for rats and cockroaches, and a developmental medium for fly larvae. Some local legislation is also helpful by banning open dumps, in the absence of state laws. Good local programs give particular emphasis to education and information to combat ignorance of basic sanitation principles, and carelessness and indifference of people, augmented by enforcement of local codes and ordinances. A vigorous code enforcement program is an effective means for developing environmental conscience. Vector control itself is carried out at the local level. State programs support the local actions.

Private Sector Activities are primarily those of commercial pest-control companies who provide a major portion of vector control in and around the home, commercial and industrial establishments, and institutions. Some large institutions provide their own pest control services using staff especially trained for these duties. The pest control industry has 20,000 to 30,000 service men each of whom visits up to 10–15 different places a day to control rats. The National Pest Control Association (NPCA) estimates $245,000,000 is spent annually by the public for NPCA services to control rats, flies, cockroaches, and other pests in homes and businesses. Some large pest-control companies conduct and/or support research. Others support research through their affiliation with NPCA which conducts or sponsors various studies.

PROBLEMS

Vector-borne diseases vary in their prevalence from state to state. Among mosquito-borne diseases, arthropod-borne encephalitis is the most important in the United States today, with a total of 1,320 cases reported during 1964, 1965 and 1966. Recent outbreaks and/or threats of outbreaks have been successfully controlled or prevented as a result of federal, state and local cooperation in California and Ohio. Malaria poses a continuing threat at this time due to the thousands of returning veterans, many with histories of foreign-acquired malaria, along with the prevalence of the Anopheles mosquito throughout the Southeastern United States. Major outbreaks of dengue in Puerto Rico in 1969 bring to mind earlier large epidemics of this disease in our Gulf Coast States. With *Aedes aegypti* mosquitoes present in large numbers, dengue could easily break out in the continental U.S. and even yellow fever cannot be ruled out as a potential problem. Spotted fever has been reported from 46 states, the largest number of cases occurring in 10 Appalachian States. Colorado tick fever, tularemia, chagas disease, and rickettsialpox occur regularly.

Death and injury from bites and stings of venomous arthropods have received greater attention in recent years. Bees, wasps, yellow jackets, hornets and ants killed 229 people in the 1950's. Spiders killed 65 people: 63 were killed by the black widow and two by the brown recluse spider. In recent years, the spread and increase in the numbers of the brown recluse spider have resulted in increased numbers of bites which cause severe necrosis and an extended recovery time. Plague is endemic in the wild rodent population of our western states with human cases occurring almost every year. Ships and planes from the Far East, including Vietnam where plague is common, carry return cargoes which could harbor rats. This makes plague an even greater threat. Murine typhus and leptospirosis occur regularly. In addition, some 14,000 cases of rat bite are estimated to occur annually in the U.S. Rat bites often involve secondary infections.

In many cases, insects, rats, spiders, ticks, etc., may not necessarily pose an actual or immediate disease threat. They are often present in such numbers or in such places as to limit the enjoyment and utilization of our environment. In this sense they are pests disturbing the well-being of man and control programs are justified on this basis alone.

State and local vector control organizations must, as a first step in program planning, obtain comprehensive knowledge of incidence and distribution of arthropod vectors and reservoirs of disease in their areas. Once the problem is clearly delineated, it is possible to plan appropriate control activities. After such programs are under way, it is necessary to keep a continuing record of incidence of vector-borne diseases and the level of vector populations as a means of measuring program effectiveness. In order to properly assess the vector problem, data will be needed covering the following areas:

1. Vector populations—the identity and prevalence of principal arthropods and rodents in the target area.
2. Disease incidence—cases of vector-associated disease in the target area.
3. Climatological conditions—such as maximum and minimum temperatures, rainfall, prevailing winds and their daily and monthly occurrence.
4. Biological factors—such as life cycle and seasonal fluctuations in vector populations, and their life requirements.
5. Psycho-social factors—knowledge of the impact of arthropod vectors and pests upon human individuals and populations, including estimates of the number of people exposed to vector populations.
6. Economic factors—assessment of the costs attributable to infestations of vectors, including the impact upon tourism, poultry, and livestock.
7. Disasters and other emergencies—a record of the characteristics of past emergencies and an assessment of possible future problems including excessive rainfall, floods, and hurricanes that are conducive to excessive vector populations.
8. Public awareness and support—knowledge of attitudes and behavior of the public and their leaders toward vector problems, and the present degree of financial support for vector control programs.

Much data on the above subjects are available in weather reports, scientific and technical publications, census reports, and health department records, including morbidity and mortality reports. Other data may be obtained from special local and state surveys.

Generally, data can be obtained through:

1. Survey of reports—to obtain information on previously known distribution and relative abundance of vectors.
2. Literature research—to tabulate the disease potentialities of known vectors and reservoirs, as well as their habits, habitats, seasonal abundance and methods used for their control.
3. Field biological surveys—to learn species, seasonal abundance and distribution and reservoirs.
4. Field ecological surveys—to provide data on predisposing causes for pest, vector and reservoir problems, such as stagnant water surfaces, exposed garbage, and accumulation of solid wastes.

Reports and informational releases are prepared to summarize and analyze survey findings. No surveys should be made if needed data are available from other sources.

State and local vector control budgets can be best supported when there is a good foundation of factual data outlining the existing and potential problems, and the means for dealing with those problems. The larger the budget, the more essential it is that it be well justified. California, for example, expended $11,000,000 during 1969 on mosquito control and surveillance, the largest in that state's history. The future of some phases of vector control is clouded by insecticide resistance, and by problems of insecticide pollution of the environment. Many cockroaches are now resistant to chlordane and other chlorinated hydrocarbons, and the housefly has long been resistant to many insecticides. Both *Culex tarsalis* and *Aedes nigromaculis* in the Central Valley of California are reported to be resistant to all previously used chemical larvicides. DDT is banned for most applications in the United States and similar restrictions are being considered for all persistent pesticides. These and other problems demand the attention of vector-control personnel as they conduct program planning activities.

OBJECTIVES

Vector control objectives may be directed toward abatement of vector populations rather than impact on human health, such as reduction in vector-transmitted disease, since the relationship between program activity and human health may be difficult to establish. Possible objectives for a state or local vector control program include:

1. Reduce the current rat population by one-third within the next three years.
2. During the next *X* years, prevent mosquito populations from exceeding the level measured in (month) of *X* year.
3. Through continuing surveillance, detect increases in vector populations and outbreaks in vector-borne disease and take timely countermeasures to prevent all vector-associated epidemics during the next *X* years.

Steps for meeting such objectives might include:

1. Conduct *X number* of orientation courses in vector control, training at least *X number* of local health department personnel, during the current year.
2. Reduce rat harborages by *X%* in the Model City Neighborhood area during the next 6 months.
3. Reduce by *X%* the number of premises out of compliance with state sanitary code by October of next year.
4. Treat *X number* of acres of swamp in (*locality*) with mosquito larvicides by (*date*) of next year.
5. Bait *X number* of premises with rodenticides in the Model Neighborhood area by the end of the current year.

Priorities are assigned to program objectives consistent with individual state or local circumstances. Priorities are governed by such factors as resources available for carrying out the functions, legislative and political mandates, policies of the agency under which the vector control program operates and estimated relative importance of actual or potential vector problems.

PLAN OF ACTION

PROGRAM ELEMENTS AND ACTIVITIES

It is important to build a capable and effective state or local program that is able to meet current vector problems and potential future problems, including those with low probability of occurrence. For example, a serious potential vector problem, such as malaria, might become a reality with the return of large numbers of servicemen from areas where vector-borne diseases, not now a problem in a state, are prevalent. Also to be considered here is potential for vector-borne diseases associated with disasters. These potentials should be positively identified and quantified where possible for operational program planning as well as research planning. Effective surveillance permits detection of sudden changes in vector populations and vector-transmitted disease rates in time to undertake effective control measures. Normally, programs include these elements and possibly more:

1. *Technical Services*
   a. Consultation on special problems provided to aid local program development. Up-to-date guidelines con-

cerning acceptable pesticides, formulations, rates of application and instructions for safe handling are provided by state to local programs and by local programs to non-governmental participants in vector control.

b. Training services provided by state programs as support to local programs. This covers both theoretical and the practical aspects of vector control.

c. Continuing reassessment of needs, including surveillance on numbers and distribution of vectors, population density trends, especially in critical areas, and occurrences of vector-associated disease.

2. *Operations—Field Control*

a. Local programs are principally concerned with direct operations. They are directed toward killing the target organisms and source reduction through educational-information activities and vigorous but judicious code enforcement where reasonable efforts at education fail.

b. Direct operations carried out by the state most often consist of demonstrations to provide examples and incentive to communities to initiate their own programs. The state prepares to carry out operational activities in the event of disaster and epidemics. They have carefully worked out plans for these emergency situations including plans for provisions of emergency consultative services and provision of temporary emergency supervisory staffs.

3. *Public Information and Education*

A well informed public willing to protect and enhance its environment, and earnestly support program goals with adequate funds and individual participation is essential to any successful program.

a. State vector control programs should have a state-wide information-education program utilizing the services of the health department's information office. The state provides guidance and/or direct support to local information-education programs.

b. All local programs should have active, continuing and aggressive informational-educational programs. It is important that the responsibility for these activities be specifically vested in one individual. This will help prevent problems of inconsistency, duplication or competition in public relations.

c. State and local programs should produce an appropriate quantity of attractive literature, posters, and visual aids to support information-education activities. However, the state information-education services should prepare the more elaborate or costly materials, such as motion pictures. The state should also provide consultation to local programs on development of materials.

4. *Research*

a. As part of a state program, it is desirable to conduct and/or support research on problems of special concern in order to develop new methods and test new materials and techniques for application to local problems.

5. *Mosquito Abatement Districts*

These separate agencies carry out mosquito control activities although local health departments sometimes conduct active control programs. They are usually directed by an entomologist who is selected by and under the general supervision of a "commission" of about five members. Districts are often organized on a county basis but sometimes include several counties or parts of one county. They are supported by a special tax levied for the specific purpose of mosquito control. In the earlier years of their development they were most numerous in resort areas but in recent years have been utilized to protect year-round population centers.

RESOURCES

It is essential that vector control be coordinated with related programs and obtain their support in attaining joint objectives. Housing and rat control programs are closely related and require joint actions to solve serious problems. Fly and rat control are dependent upon proper handling of solid wastes. However, vector control should exist as a separate program, operated by a single agency, to ensure consistency in direction and availability of adequate technical competency. The private sector, as exemplified by the licensed pest control operator, cannot be neglected as a resource. In some states pest control operators are licensed after meeting certain minimum standards, thus helping ensure that their efforts will be consistent with public health. Current and anticipated resources should be carefully determined. Budgeted money and positions should reflect availability of manpower, knowledge, and physical facilities and potential for assistance and cooperation from related agencies and institutions.

CONSTRAINTS

Availability of resources is the major constraint in vector control planning. Merit-system salary scales affect the availability of manpower by being too low to attract qualified personnel. Other public health programs compete vigorously for funds and for environmental health manpower which might be applied to vector control. Legislative actions may serve to limit the range of a vector control program, such as when legal responsibility for mosquito control is vested in the state university. Political policy trends favorable or unfavorable to effective health department leadership in vector control should always be followed and appropriate action taken where possible.

RELATIONSHIPS

State vector control agencies should provide promotion and support in development of strong local programs. They should provide encouragement in the form of leadership and technical guidance and even temporary supervision and funds. Local programs must maintain a good image in the community and work constantly at developing and maintaining good working relationships with other community departments, agencies, and groups. Coordination of vector control activities between the state health department and other state departments and bureaus is best assured by regular meetings of departmental heads, or their representatives. Also, every effort should be made to foster cooperation between these departments and representatives of federal agencies such as PHS, USDI, USDA, U.S. Department of Transportation, HUD, and the Army Corps of Engineers. Among environmental factors of mutual concern to such agencies are recreational areas, impoundments, urban renewal and Model Cities sites, solid wastes, highway drainage, wildlife that serve as reservoirs of human disease, and transportation facilities. Increased urbanization and complexity of our society has greatly increased need for coordination to avoid duplication of efforts.

Cooperation between all agencies whose activities impinge upon vector problems is equally important at the local level. For example, the Philadelphia rat control project has field operations and objectives coordinated at operational level by a field coordinating committee. Planning activities are coordinated at departmental level by monthly meetings held in the mayor's office. Many federal agencies provide state and local agencies with funds and consultation to achieve the objectives of their joint programs. Federal funds from HEW are provided for city rat control projects and other such projects are funded by HUD. Federal funds are used by Florida's vector control agency to support research on insect vectors, primarily mosquitoes. Other relationships may involve agencies with seemingly incompatible interests. For example, health department mosquito control projects may consider dewatering marsh areas or the use of pesticides which may be deleterious to wildlife, the concern of the conservation agency. Efforts to coordinate activities of agencies with seemingly divergent interests and to promote understanding are necessary to the achievement of many program objectives.

IMPLEMENTATION

Important actions necessary for implementing vector control programs include:

1. Obtain adequate funding for the planned program.
2. Establish an efficient administrative structure.
3. Provide for careful recruitment and training of staff.
4. Establish attractive salaries and personnel policies.
5. Institute a working advisory committee selected from the community or state.
6. Achieve good coordination of efforts with other related departments, agencies or groups.
7. In case of a state health department program, establish a state pesticide review and advisory board.
8. Establish a state licensure program for pest-control operators.

Activities in states with major vector problems may be organized as a line function with bureau or division status. Without this visibility and status the responsibilities for this function cannot be discharged adequately. In states with no large urban areas, sea coast mosquito breeding sites, or major irrigation areas, vector control can be accomplished by a smaller organization as a part of a bureau of preventable disease or similar line function. In all cases it is necessary to staff the vector control function with a well qualified entomologist to direct the activity, plus supportive personnel. Whereas some states assign additional workers to each of the regions in a state, an optional procedure is to create a single state staff, representing many different specialities. These may include experts in taxonomy, field inspection, chemical and mechanical operations, rodent surveys and control, and training, among others. The success of a state vector control program will be reflected at the local level. It is necessary that priorities, emphasis and resource allocation be oriented toward the most effective pest and vector control possible under existing circumstances. The way in which state and federal funds are allocated to local programs can provide a continuing incentive toward effective direction of efforts to fully meet local health needs. State assistance may also be given in developing and promoting necessary legislation.

EVALUATION

To permit effective program evaluation it will be necessary to include, as an integral part of the program, continuing collection of information pertaining to changes in the problem as well as information concerning program activities. These same kinds of data would, when collected at different times, reflect changes in the problems, permitting a determination as to whether or not program objectives have been met. Thus, the ultimate evaluation would be concerned with the changes which have been stated as objectives, such as reduction of vector populations, reduction in number and extent of breeding places, improvement in environmental sanitation levels, and, where appropriate, reduction in morbidity or mortality. Short-term evaluation would be based on previously established action steps which have been assumed to be indicators of progress toward the objectives even though they are comprised primarily of program activities or outputs rather than direct impacts on the vector problems. One example of evaluation of action steps as well as direct impact on the vector problem would be conducting a comprehensive rat survey. Repeating the survey annually will reveal progress in reducing numbers of premises with rat infestations, unsatisfactory refuse storage, rat harborages and other factors conducive to large rat populations. The program evaluator must receive a regular flow of information pertaining to such activities as training courses conducted, city blocks inspected, and acres of mosquito breeding grounds treated, so as to determine whether or not the program is remaining on schedule in progressing toward its objectives. If not on schedule, the necessary changes should be instituted to bring it back on schedule. Whether or not the action steps selected do, in fact, measure progress toward the objectives will not be known for certain until the target date for attainment of the objective is reached. If, in spite of completing action steps on schedule, the objective is not attained, then a different set of action steps and/or program modifications may be in order.

PESTICIDES

INTRODUCTION

Today man is exposed to an ever increasing number and variety of chemicals, one group of which is pesticides.[1] Although pesticide chemicals were known and used before World War II, their use has increased significantly. New, more toxic compounds, such as the synthetic organic pesticides have largely replaced the older compounds. Little information is available to evaluate the hazards associated with use of the newer products. Our society has gained tremendous benefits from the use of pesticides, fungicides, herbicides and plant growth regulators to prevent vector-borne disease, to control insect pests, and to increase quantity and quality of foods and fibers. The need to use pesticides and other pest-control chemicals will continue to increase for the foreseeable future. However, recent evidence indicates a need to be concerned about unintentional effects of pesticides on human health and on various life forms within the environment. Residues have been found in human and other animal tissues, in food, clothing, water, soil, and air. It is apparent that the benefits of using pesticides must be considered in the context of the present and potential risks of pesticide usage. Corrective action must be taken now to protect the health of man and prevent further environmental pollution from pesticide residues.

MISSION

The mission of a pesticide control program is to protect man and his environment from the adverse effects of pesticides. National pesticide control efforts include:

1. Determining pesticide use patterns most advantageous to man and his environment.
2. Determining effects of long-term exposure to low levels of pesticides.
3. Regulating and controlling selection, use, transportation and storage of pesticides; and disposal of pesticide wastes to minimize or eliminate direct effects on man or indirect ones through pollution of his environment.
4. Advising consumers at all levels on proper methods for handling, storing, using and disposing of pesticides.

FEDERAL ACTIVITIES

1. *U.S. Department of Agriculture (USDA)*

Statutory authority under the Federal Insecticide, Fungicide, and Rodenticide Act for registration and proper labeling of pesticides. Responsibility for research, education, information, and regulatory and action programs designed to protect the well-being of man, crops, livestock, forests, ranges, habitats, products, structures, and premises against arthropod and vertebrate pests, weeds, and fungi, with equal concern for the protection of beneficial non-target organisms and the quality of the environment.

2. *U.S. Department of the Interior*

Statutory authority and responsibility under the Federal Water Pollution Control Act to carry out programs to protect and enhance the quality of the Nation's waters, including determining effects of pesticides in water on health, welfare, and aquatic life including establishing water quality standards for interstate waters. Also statutory authority for conservation of wild birds, fish, mammals, their food organisms and their environment as affected by pesticides and the appraisal of effects of pesticides on fish and wildlife.

3. *U.S. Department of Health, Education, and Welfare (HEW)*

Statutory authority and responsibility under the Federal Food, Drug, and Cosmetic Act for establishing safe tolerances for pesticides in or on raw agricultural commodities, processed food and potable water. Also responsibilities

---

[1] The term "pesticide" means such substances as insecticides, fungicides, rodenticides, herbicides, nematocides and plant regulators as defined in the Federal Insecticide, Fungicide and Rodenticide Act.

Preceding page blank

for protecting the public from health, occupational, and environmental hazards related to use and disposal of pesticides, and for other public health aspects such as the control of diseases and their vectors. The Food and Drug Administration, Public Health Service, HEW, has direct responsibility to establish and enforce pesticide tolerance levels in foods moving in interstate commerce. FDA reviews pesticide labels and toxicological data to appraise USDA of adequacy of directions for use and precautionary statements.

4. *Department of Transportation*
Establishes regulations governing the transportation of hazardous materials, including pesticides, in interstate and foreign commerce. These regulate the conditions under which these hazardous chemicals may be shipped via common, contract and private carriers.

Activities of the various departments are coordinated through the Pesticides Subcommittee of the President's Committee on the Environment.

STATE AND LOCAL ACTIVITIES

Potential hazards to man's health resulting from use of pesticides and their presence in the environment are recognized by all states. Some states have initiated programs to control the use of pesticides, others have initiated pesticide surveillance activities with respect to public water supplies and/or food products. Public information efforts are being pursued to acquaint the general public with the adverse health effects that may result from the indiscriminate or improper use of pesticides, as well as the dangers of improper storage and disposal of these products. The states are generally assuming a larger share of the total workload pertaining to pesticides with exchange of information between the states, FDA and other Federal agencies. This is made possible through consultation and is reflected in grower surveillance, environmental sampling, occupational health, improved legislation, improved vital statistics records and diagnosis of pesticides-related illnesses.

County extension agriculture agents advise farmers on the selection of preferred pesticides for a given problem, the safe use of these materials, and proper disposition of containers of unused chemicals. Many states and localities have organized mosquito control activities utilizing pesticides as the primary control measure. There are similar programs carried out at the state and local level for control of specific health and economic problems such as plant diseases, rodent control, and insect-borne diseases. Many academic institutions, primarily land grant colleges, conduct research and provide technical assistance and consultation in the field of pesticides. Industry and professional associations provide guidance to pesticide chemical users and applicators as to proper handling and applications of chemicals.

PROBLEMS

ENVIRONMENT CONTAMINATION BY PESTICIDES

About 763 million pounds of 900 pesticide chemicals are produced and used annually in the United States for agricultural, industrial, and home purposes. The large scale use of these chemicals poses many problems to Federal, State, and local officials concerned with protection of public health and environment. Significant problem areas include the following:

1. Misuse of approved pesticides by growers, applicators, vector-control programs (i.e., excessive application; selection of wrong formulation, etc.).
2. Accidental contamination of food sources; improperly contained pesticide application, such as wind drift from aerial application; use of contaminated irrigation water, and residues in soil from previous application to other crops.
3. Careless and accidental release of pesticides while in storage or transit. Such incidents lead to contamination of other commodities and are potentially dangerous to man and environment.
4. Improper disposal of waste pesticide chemicals and pesticide containers may contaminate surface, ground and estuarine water and the air or soil.
5. Contamination in formulation and/or packaging of specified pesticides with

other pesticides not specified on the label.

6. Pesticide poisoning in the home contributed to 5,739 reported poisoning cases, including 3,965 among children under five years of age. This data is from the Poison Control Centers for 1968, with poisoning defined as ingestion. The number of unreported cases of accidental pesticide poisoning has been estimated at about 15,000 based on 100 poisoning cases for each death reported from all sources. About 12% of the toxic substances most frequently ingested by children under five years of age are pesticides. Pesticides contributed, in large part, to 2,200 deaths from ingestion of hazardous substances. Some 350 of these were children under five. Consumers frequently do not realize or understand the importance of careful handling, use, and storage of these products around the home.

7. Diagnosis and reporting of illnesses and deaths due to exposure to pesticides is far from adequate, thus preventing proper recognition of the problems. The consequences of acute overwhelming exposure to individual pesticides may be easily recognized. The more subtle effects of long-term, low-level exposure to a variety of pesticides singly and in combination are still to be identified in full and evaluated. Another effect of pesticides to be studied and evaluated is their relationship to the effectiveness of drugs. Unless these effects are properly documented and reported, their true incidence cannot be determined. Community epidemiologic studies may provide leads to the chronic hazard of pesticide exposure from all sources.

8. Overall, there is the problem of contamination of the environment by persistent pesticides which not only affect the ecology but also finds their way back into man's food chain. The recent discovery of high levels of DDT in the flesh of Coho salmon taken from the waters of Lake Michigan is illustrative. Low DDT levels in the water were concentrated in the salmon through its food chain and thus presented a potential food product hazard for man. These compounds are also present in potable water and air.

9. Occupational exposure to pesticide chemicals by workers directly involved in manufacture, handling, or application of pesticides is another problem for officials concerned with the protection of the public health. Possible harmful effects to migrant agricultural workers, who commonly work at such jobs as thinning, weeding, or picking, have not been the subject of specific investigation. Residues on crops have, in few instances, caused poisoning in agricultural workers from occupational exposure.

OBJECTIVES

Long-range goals of a pesticide control program are:

1. Assure that pesticide residues in raw agricultural commodities and other foods do not exceed established tolerances.
2. Reduce the present level of contamination of the environment by pesticides.
3. Reduce the number of deaths and injuries caused by exposure to and ingestion of pesticidies.

Appropriate short-term program objectives include:

1. Implement monitoring involving sampling of primary raw agricultural commodities grown in the area to determine if pesticide residues are within established tolerances.
2. Provide for prompt removal from channels of commerce of foods found to contain pesticide residues in excess of federal tolerances.
3. Establish a program of annual inspections of growers and pesticide applicators to insure proper use of pesticide chemicals. More frequent inspections would be made as need is determined and funds and manpower permit.
4. Develop safe, effective means of pest control in the form of readily degradable chemicals or biological control agents and encourage adoption of these means.

5. Establish monitoring to determine present contamination of environment by pesticides using air, water, and soil samples as key indicators.

6. Implement safe disposal of pesticide containers, unused chemicals and damaged lots which, if improperly handled, posed a threat to public health and environment.

The federal government has overall responsibility for registration of pesticides, establishing criteria for their use, setting tolerances for residues in foods and carrying on long-term research required for development of answers to many pressing problems. State program objectives should also be concerned with these items within their areas of jurisdiction as well as with identification and solution of specific and possibly unique problems within their boundaries. They should develop educational and, if needed, control programs aimed at preventing accidental or deliberate misuse of these chemicals.

PLAN OF ACTION

In order to attain necessary level of action at the local level, states must develop their own programs pertaining to varied aspects of pesticide usage and ultimately of other chemical pollutants. Such programs would complement federal effort and can be more effective when directed towards specific local problems. However, many states do not presently have the necessary resources to undertake such a program. State pesticide control programs should include:

1. Determination of agencies having responsibilities for investigation and control of use and effects of pesticides and evaluation of the scope of their activities.

2. Determination of extent of the problem, including pertinent demography, pesticide usage, formulation and manufacture, disposal practices, reported morbidity and mortality.

3. Identification and evaluation of capabilities and resources, such as laboratories and field personnel, needed to effectively monitor pesticides.

4. Review of existing legislation and determination of legislative and budgetary needs for proper authority and support to conduct an adequate program.

5. Operation of an educational activity designed to ensure safe use of pesticides at all levels concerned with handling, transporting, application, storage, and disposal. The public should be made aware of the inherent hazards of pesticides and of the importance of adhering to the label instructions on specific uses for which intended and precautions in use, storage, and disposal.

6. Arrangement to ensure safe disposal of pesticide wastes; reporting to one central office of pesticide spills, accidents and flagrant misuse; enforcement of tolerances for pesticide residues in foods; improved clinical diagnosis and treatment of pesticide poisonings through increased physician awareness; improved reporting of pesticides poisonings and fatalities; occupational health protection for all involved with manufacture, formulation, storage, transportation or application of pesticides; and staff competence in all aspects of pesticides through formal training, on-the-job training, and consultation.

7. Development of mechanisms for exchange of information between responsible agencies and coordination of activities to prevent duplication.

Items 1 through 5 are listed in suggested order of priority. Items 6 and 7 would be implemented as soon as possible.

CONSTRAINTS

Due to the highly technical laboratory program, many states cannot afford a comprehensive pesticide monitoring program. Other constraints include the following:

1. Lack of qualified personnel and instrumentation to conduct the highly sophisticated analysis required to detect and measure pesticide contamination.

2. Lack of legal authority at the state level to conduct an effective regulatory program.

OTHER AGENCY INTERFACES

The primary agencies concerned with pesticides in the state normally are the departments of health, agriculture, and natural resources. Close coordination between them is essential to effective control. Colleges and universities involved in research and development provide consultative services to state agencies and users of pesticides.

COMMUNITY STUDIES

FDA currently has 15 community studies in progress under contract with state health departments and universities. These studies consist of epidemiological and ecological investigations in areas of heavy pesticide usage throughout the United States. Data derived from these studies could assist in identifying problem areas that need attention under a state-wide pesticides control program.

IMPLEMENTATION

ORGANIZATION

State agencies responsible for administering programs which impact upon pesticide hazards present a complicated picture. Agency responsibilities range from registration and control of pesticide applications to environmental controls of the pollution of air, water, households, foods, and feeds, and include safety hazards to man through manufacture, storage, distribution and use. State registration of pesticides is generally the responsibility of departments of agriculture or land grant universities. Environmental contamination is controlled by health, agriculture, natural resources, water and air pollution control, and recreation. The multiple agency pattern is also prevalent in controlling manufacturing storage, distribution and use. A focal agency must be designated with responsibility for coordinating all state level activities to assure their consistency and completeness. CHP can play a vital role in this coordination.

PERSONNEL

Two basic fields of expertise are required:

1. Competent field and staff knowledgeable as to characteristics, limitations, approved uses, methods of application of pesticides and chemicals and in public health procedures. These individuals should have training and experience in the basic sciences (biology, chemistry, etc.) relating to pesticide chemicals and their use. Staff should include agricultural or similar inspectors familiar with areas, crops, and pesticide chemicals.
2. Scientific staff with capabilities in laboratory analysis and data interpretation. Staffing requires chemists and biologists well trained in analysis of samples for pesticide residues as well as knowledge of the sophisticated equipment used in pesticide laboratories.

TRAINING

In-service training should be incorporated as an integral part of a pesticide program in order that staff may be developed and may maintain current awareness of new developments, methodology, techniques, and standards. Specialized training courses for state personnel are available from various federal agencies with responsibilities for investigation and regulation of the economic and public health utilization of pesticides. USDA and HEW can provide significant training assistance to state and local programs through numerous federal training courses and seminars. FDA offers technical assistance to state health departments in development and improvement of pesticide-related health programs through the State Pesticide Project. Also, on-the-job training for state chemists and field investigators is available from FDA District and Regional field offices.

LEGISLATION

Existing legal authorities should be determined, and areas of responsibility clearly defined. Deficiencies noted in legal authorities necessary to an effective program should be remedied as soon as possible to insure that the total mission of the pesticide program is provided for. There might be need for legal authority for licensing of commercial applicators, control of major pesticide waste disposal (surplus chemicals, containers, contaminated products), requiring separating of clinical illness from pesticide poisonings, and control of pesticide residues in foods.

EVALUATION

The effectiveness of a pesticide program should be evaluated in terms of success in meeting objectives. And such success will be measured in terms of:

1. Decrease in the number of accidental injuries due to pesticides used in and around the home. Data from poison control centers and state's bureau of Vital Statistics could be used to make this determination. As reporting measures improve, there may be a rise in the number of deaths and illnesses because of better reporting methods, however, this trend would be reversed as the public education program and control efforts become more effective.
2. Increase in utilization of alternate and safer methods of pest control.
3. Increase in compliance with approved uses of particular pesticides as to application rates and recommended good pesticide utilization practices.
4. Continued conformance of pesticide labeling with established requirements.
5. Increase in the level of compliance by food producers in sampling of products for laboratory analysis for pesticide residues and maintaining standards.

A properly designed and executed program should result in a decrease in the misuse and abuse of pesticide chemicals. Constant evaluation is needed to determine if this goal is being met.

RESIDENTIAL ENVIRONMENT

INTRODUCTION

Residential environment is defined as the dwelling unit itself and those adjacent units and spaces with which it is associated. From a health standpoint the residential environment is both the dwelling and its neighboring environs within a six to ten minute walking distance. The dwelling and that area are functionally interrelated both in terms of sanitation problems affecting physical health and nervous tension release affecting mental health. The dwellings, the structures containing them, their yards or premises, their neighborhood within a reasonable time-distance, and their circulation ways and common areas (social, recreation and open space) facilities within that adjacent area together comprise the residential environment for health planning purposes.

The total impact of physical residential environment on the health and well-being of the individual and the population is only partially known. A functional concept has yet to be developed that effectively views man in relation to his physical built-environment. Until such research is done we shall not fully perceive the relationship of man to shelter and its associated surroundings. Information presently available strongly suggests, however, that effective environmental programs can bring about conditions that will favorably influence health, well-being, attitudes, habits, emotional and social stability. The health agency is in a unique position to lead in residential environment improvement programs.

The residential environment represents a complicated public health problem. There is a marked correlation between substandard housing and poor health, reflected in morbidity and mortality rates. Conversely, controlled studies have confirmed that improved housing reduces the incidence of illness and death.

MISSION

The principal mission of public and private agencies concerned with the residential environment is to reduce the percentage of the population living in substandard housing and minimize exposure of the population to unnecessary residential environmental hazards.

CURRENT STATUS OF PROGRAMS

Federal

Within the Federal structure, the U.S. Public Health Service (PHS), Department of Health, Education, and Welfare, has primary responsibility for health-oriented programs relating to the built environment, including public health aspects of housing and neighborhoods. PHS develops environmental surveillance and monitoring systems to help define health problems relating to dwellings and their neighborhoods as well as other urban environmental hazards. It conducts training programs for personnel in housing control programs and other related environmental improvement programs such as Model Cities. It also develops model codes and researches the health criteria for standards for housing and neighborhoods.

To help communities to augment community health manpower resources, PHS assists in the development of programs designed to train citizens as health educator aides to help other residents to help themselves gain and maintain improved standards in their residential environments.

Other agencies of the Department of Health, Education, and Welfare (HEW) provide financial subsistence to many impoverished individuals and families. Because much of this support is expended for shelter, HEW is much concerned with the quality of housing available to low income groups. The Department of Housing and Urban Development (HUD) has primary responsibility in providing financial assistance for development of new housing and maintenance of the present supply along with urban, suburban and/or metropolitan development. U.S. Department of Agriculture (USDA) provides funds for construction, maintenance and improvement of farm and rural non-farm housing. The Department of Commerce, National Bureau of Standards researches the engineering criteria for building and equipment standards.

STATE AND LOCAL AGENCIES

Responsibility for residential environment on the State and local level is dispersed. Dealing with the general residential environment is usually the responsibility of State and local health agencies. Sometimes at the State level, responsibility for residential environment improvement is vested in a department of community affairs. In some cases these programs are a joint responsibility of both agencies. A number of states do not have comprehensive residential environment programs. In a recent survey (1968), with 47 state health agencies reporting, 14 indicated they had ongoing housing programs, and only 13 had a housing and maintenance code. Major activities of state health agencies with programs were provision of technical consultation, training, and guidance materials to local code-enforcement agencies. Only two states reported identifiable budget allocations for housing. In recent years some 25 States have established departments of community affairs. These have come into existence chiefly through financial assistance from HUD. Most state health agencies have environmental health regulations that affect the residential environment. These cover housing, sewage disposal, water supply, solid wastes, vectors, and general environmental conditions.

Residential environmental activities at the local level have increased rapidly in the past few years. In 1956, fewer than 100 of the larger cities had housing codes. In 1968, some 4,904 local governments had housing codes with 3,000 participating under the "workable program" provisions of HUD. In communities which have a housing program, administrative responsibility is usually shared by health departments, housing inspection and redevelopment agencies, building departments and other municipal agencies. Some of these same agencies administer building codes (construction, fire protection, plumbing, electrical) and are responsible for zoning and other planning activities.

PRIVATE

Non-government organizations at national, state and local levels such as neighborhood councils, tenant associations, and metropolitan and regional groups play a large role in fostering developments in governmental programs for housing and neighborhood improvement. Participation of such groups in strategy development, program planning, and implementation is of great help at all levels. In 1968 only a few corporations had undertaken housing development and research. Since advent of new federal programs providing incentives for private investment and participation in low-to-moderate income housing, business involvement has become more extensive.

PROBLEMS

The public health significance of residential environment is its effect upon the physical, mental and social well-being of the population.

HEALTH

The extent of the relationship of mental illness to the residential environment is under study by many investigators. Many researchers believe that the irritations, frustrations, and invasions of privacy that occur in some residential environments are leading causes of contributing factors to mental illness. The residential environment influences the social well-being of many and may be both directly and indirectly responsible for many of the social ills predominant in areas where the residential environment does not provide the physical, mental and social needs of the people.

A number of diseases are related to inadequate housing. Many respiratory infections (colds, bronchitis, influenza), are related to inadequate heating or ventilation and inadequate and crowded sleeping arrangements. Digestive-tract diseases (dysenteries, diarrheas) are causally related to crowding, inadequate water, sewage, and multiple use of toilet, water, sleeping, and food-handling facilities. Other diseases associated with poor housing include lead poisoning in children from eating lead-based paints and carbon monoxide poisoning (from improperly constructed, installed or maintained home heating devices). Rats proliferate where environmental sanitation is inadequate. In 1965, 6,000 cases of rat-transmitted diseases and 14,000 cases of rat bites were estimated nationally. Accidents in the home environment affect about 25 million persons each year. These accidents are related to such causes as crowded or inadequate kitchens, poor electrical connections, and poorly lighted and unstable stairs. About ⅓ of all nonfatal injuries and more than ¼ of all fatal injuries occur in and around the home. Each year home accidents injure more than twice as many persons as work accidents and four times as many as traffic accidents.

PHYSICAL DIMENSIONS

There are at least 6.7 million occupied substandard dwellings in the United States (about 10 percent of available units). Four million of these lack one or more essential indoor plumbing facility; 2.7 million are in such poor condition that they cannot be rehabilitated without major repair, and 4 million of standard quality are overcrowded. This represents 11 million substandard dwellings (three out of every 20). Some 6.3 million of these are found in rural areas. Physical environmental factors having impact on the health of occupants include: structural conditions of buildings, recreation, basic services and utilities, police and fire protection, solid waste collection, sanitation, transportation services, and distances which must be traveled to reach activities or acquire services.

SOCIAL AND ECONOMIC IMPLICATIONS

Unemployment, school dropout, illegitimacy, alcoholism, drug addiction, delinquency and crime tend to be in greatest concentration in areas of substandard housing. Welfare departments are valuable allies in the study of cause and effect relationships and can be of real aid in assuring that recipients under their various programs are not housed in poor dwellings. The goals of welfare programs are enhanced when health officials help welfare agencies insist upon standards being met by landlords and tenants. Particularly where vendor payments are made for shelter, the welfare agency can insist upon compliance with acceptable dwelling standards.

MEASURING PROBLEMS

Sound program development requires that residential environmental health problems be defined and their magnitude determined on both the state and local levels. Among the information needed for defining the problem is:

1. Demographic data including morbidity and mortality. Excess morbidity and mortality in the young and elderly are usually found in greatest concentration where housing and environmental conditions are most hazardous.
2. Housing data determining the quality of housing, including percentage of deteriorated and dilapidated housing and housing lacking basic sanitation equipment, such as hot water, plumbing and other pertinent details.
3. Information concerning the amount and effectiveness of current housing improvement efforts, such as construction and sanitation code enforcement and zoning.
4. Information on planned land use as in housing, industrial and transportation development.
5. Neighborhood environmental data, including circular safety, presence or lack of common areas for the more land-crowded environs, yard and public way sanitation, rodent and other vector evidence.

OBJECTIVES

Specific objectives vary due to political, economic, administrative and technical factors. Objectives should be directly related to the problems defined, should be consistent with the responsibilities and authorities of the parent organization, and should be consonant with overall community-development goals, plans, and activities. Some examples include:

1. Develop and attain adoption of adequate housing standards by end of year.
2. Reduce fatal home injuries by 10 percent and nonfatal home injuries by 5 percent within two years.
3. Reduce by 50 percent the number of lead poisoning cases in children due to residential environmental exposure within $1\frac{1}{2}$ years.
4. Bring 25 percent of deteriorating-but-sound structures up to minimum standards; and eliminate 10 percent of structures dilapidated and beyond improvement within five years.

PRIORITIES

Priorities vary with locality. Priorities are developed on the basis of health and aim at problem areas having the greatest health hazard potential. Priorities are evolved from considerations of available resources, relative need, legislative and political mandates, policies of the parent organization, and emergence of new needs.

PLAN OF ACTION

Objectives, if realistically developed from accurate information, serve as targets for action. The plan of action should relate to the objectives and reflect a realistic approach to achieve objectives. Alternative plans of action should be considered and the most effective and feasible identified. Effectiveness will be estimated on the basis of cost-effectiveness and other analyses. Feasibility will be determined in part by accurate assessment of existing constraints. Constraints to housing and residential environmental programs include:

1. Lack of adequate legislative authority to control the multitude of conditions having impact on health in the residential environment.
2. Lack of resident community organization to support environmental plans and help their implementation.
3. Lack of adequate funds and manpower to maintain effective control efforts.

PROGRAM ACTIVITIES

The following are included in a good program:

1. *Environmental Surveillance.* The extent of surveillance is dependent upon the status of housing quality. Normally, a surveillance program defines the size and nature of extremely substandard areas and identifies causative agents, assesses each area of the community according to quality, and determines the degree of compliance resulting from housing code enforcement. In designing an environmental surveillance program it is important that data be obtained through a preoperational survey defining as many of the environmental conditions as possible. Effective surveillance programs require that adequate standards such as housing code and public health laws and regulations be up-to-date, technologically sound, workable and enforceable.
2. *Public Information.* Public opposition to a residential environment program may result if there is a lack of knowledge among the public to the objectives of the need for the program. The general public must have a clear understanding of the program. It is essential, therefore, that an educational program be developed and carried out. A good public information program includes:
   a. Keeping the general public informed of housing survey results, special studies, and program activities.
   b. Involving the community citizenry and the target neighborhood residents through committee work, group discussions, and neighborbood meetings as pertinent (refer to Community Organization Techniques Series listed in Bibliography).
   c. Utilizing community residents to explain the program to the commu-

nity, especially involving the influentials in face-to-face conversations with their followers (reference #16).

d. Utilizing radio, television and newspapers, pamphlets and other media.

e. Developing information programs directed to landlords and tenants defining their responsibilities for maintaining housing and premises.

f. Introducing training programs into the school system, and allied professional and civic organizations.

3. *Criteria and Standards.* An essential activity is the development of codes, standards, rules and regulations to exercise effective control of the residential environment. This activity may be in three forms:

a. Revision of present standards to reflect the problems of the community.

b. Development of new standards to control problems presently being ignored.

c. Assisting allied agencies in revision and development of standards to insure uniformity and inclusion of health and safety considerations, such as under the building code and its related electrical, plumbing and heating codes and under zoning ordinances and subdivision regulations, etc.

The environmental health agency will probably be directly involved in developing and administering the housing occupancy maintenance code. There are four Model Codes which may be used as reference if revision or development of the housing code is necessary. They are:

a. APHA-PHS Recommended Housing Maintenance and Occupancy Ordinance.

b. Basic Housing Code of the Building Officials' Conference of America (BOCA).

c. International Conference of Building Officials (ICBO) Uniform Housing Code.

d. Southern Standard Housing Code.

A good housing code consists of standards based on housing situations of the state or local municipality. The model codes are used as guides and are amended to be compatible with the housing problems and state and local laws. The APHA-PHS Model Code is more closely related to human needs of housing while the other codes emphasize construction and design.

4. *Enforcement Activities.* Housing code enforcement, in its simplest form, consists of (a) Inspecting dwellings to determine compliance with requirements of the code; (b) Informing the owner, occupant, or other responsible party of existence of violations and requesting or ordering removal of the violations by restoring dwelling to a condition that meets legal requirements; (c) Persuading or compelling the responsible party to comply if he fails to do so on his own. Legal enforcement of a municipal code is dependent on state and local laws prescribing housing standards which provide the source of power or authority for enforcement sanctions and remedies. The health agency, in conjunction with legal counsel, must establish standard procedures, compatible with state and local laws to be used when legal proceedings are necessary to obtain compliance with the housing code.

5. *General Activities.*

a. The health agency provides housing services to public and private agencies responsible for planning, development, operation and management of the residential environment. These agencies should be encouraged to request inspections and technical assistance to certify compliance with housing code standards.

b. The health agency carries out surveys and inspections of housing on behalf of the municipal planning organization to determine housing conditions and degrees of blight as part of communitywide and special studies of neighborhoods.

c. The health agency maintains activities to supply the urban renewal agency with information relating to housing conditions for the preparation of survey and planning applications in connection with designated renewal projects.

d. The health agency develops a capability for certifying whether housing for relocation purposes meets standards.

e. Other direct services provided by the health agency include: inspectional and related services to: welfare organizations, antipoverty organizations, banks (in connection with the issuance of certificates of code compliance), non-profit housing corporations (as part of their activities in the acquisition, rehabilitation, operation, lease and sale of housing to low-income persons) and assistance in demolition of dwelling structures.

6. *Research.* In addition to routine program activities, plans should be developed for special studies of known or suspected problems and situations where additional information is needed before new program plans can be established, or meaningful evaluations made. These studies include planning and design of new neighborhoods, methods to enhance effectiveness of enforcement effort, epidemiological studies, etc.

COORDINATED ARRANGEMENTS WITH OTHER PROGRAMS OR AGENCIES

There is need for coordination and cooperation on the part of all interested agencies in planning the whole residential environment. The task is often too great for any one agency, and the complex nature of the problem calls for the combined knowledge and skills in all allied fields. The health agency should be an active leader in this team approach. Examples of allied agencies related to residential environment problems are:

1. Planning agencies (city planning, land-use planning, economic development planning, zoning) serve as major sources of information and data pertaining to conditions of housing and neighborhoods. They also establish goals and objectives for long-range development of the city which are essential in the planning of housing as well as other health-related programs.

2. Other state, municipal and community agencies that may be of assistance to the health agency in housing improvement include welfare and public assistance agencies, low-rent public housing agencies, urban renewal agencies, departments of public works, building departments, citizens health and welfare committees and neighborhood improvement associations. Some federal agencies may be of technical and financial assistance to state and local housing programs including PHS, the Social and Rehabilitation Service of HEW, HUD, USDA, and the Building Research Division, Institute of Applied Technology; National Bureau of Standards (Dept. of Commerce).

RESOURCES

Tangible and intangible resources are found at the local, state and federal levels to assist the operation of the residential environment improvement program. Large resources of unskilled but trainable personnel are available in most communities to serve as housing inspectors, sanitation aides, health education aides, and in other paraprofessional categories. Both technical and financial assistance are available from the state and federal levels. Most funding will come from programs authorized by federal housing legislation, including HUD's programs of comprehensive planning assistance, code enforcement, urban renewal, rehabilitation loans and grants, and housing for low and moderate income families. Frequently overlooked resources include organizations set up as advocates for better housing for the poor (tenant councils, tenant corporations and tenant unions). These should be involved in the planning and policy decisions relating to housing to help ensure more realistic programs.

IMPLEMENTATION

The program selected must be based on identified problems and established objectives. Implementation of the program is dependent upon resources and their effective use. The major elements of program, implementation consist of providing for organization, personnel, training, legislation, fiscal support, interagency coordination and data records.

ORGANIZATION

Focal point of the housing program should be in the health department. At least, all activities of residential environment improvement justified on the basis of health should be placed under a single health agency jurisdiction. Other state and local agencies should be involved in the program according to their respective capabilities and legislative mandates. An advisory committee can be established both on a state and local level to serve as a coordinating unit to insure coordination of all programs directed at housing and redevelopment. Membership on the committee should consist of a representative from each of the operating programs having responsibilities in residential improvement. This committee should have the authority necessary to effect necessary changes in the operating programs to accomplish concerted and effective impact on residential problems.

PERSONNEL

A broadly-based program requires many disciplines including engineers, sanitarians, rehabilitation specialists, urban planners, housing inspectors and inspector aides. Auxiliary consultation assistance from specialists such as epidemiologists, ecologists, medical, social, or biological scientists is necessary to carry out a well-balanced program. The personnel system should be based on merit system classifications, job descriptions and career development. The number of personnel needed will vary greatly with the individual state or city and their various problems.

TRAINING

Highly trained environmental health manpower is a premium. They must be supplemented with less expensively trained inspectors, inspector aides and other similar classifications. A good program must provide for continuing training programs for its personnel to keep them abreast of current developments as well as an adequate orientation training program for replacement staff.

RECORDS

Well-designed procedures and facilities should be established for the collection and assessment of data. The residential environment program will need to record two major types of data:

1. Basic characteristics of residential structures such as address, owner's name and address, block and lot number, type of construction, number of stories, number of rooms, valuation, rentals, etc.
2. Changes in housing use and conditions determined by regular surveys, special surveys, area and cycle inspection, license and certificate inspections, permit and complaint inspections, violations and enforcement data, demolition data, government repairs data and rehabilitation data.

A growing number of cities are maintaining computerized data banks, many planned and set up with federal assistance, which incorporate housing data files. Most often, however, these files contain only data on the basic characteristics of housing and omit data indicating changes in housing use and conditions.

EVALUATION

Precise evaluation is crucial to the success of the program. The scheme should incorporate interim progress measurements as well as end-of-term achievement so that modifications can be made in the program if necessary. The end-of-term measure will serve an additional function, that is, to evaluate astuteness of the overall plan. This will help in development of better future program plans. In this connection, an intense analysis should be made if at the end of the program term it is found that objectives have not been achieved. Over-achievement, as well as underachievement, is indicative of a faulty plan of action.

The quantitative evaluation measures should be specifically tied to the quantitative statement of each objective.

INSTITUTIONS

INTRODUCTION

Most political jurisdictions contain institutions used for housing or confinement for varying periods of time: hospitals, nursing homes, clinics, day-care centers, universities, penal institutions, homes for the orphaned and the elderly, and schools. These institutions constitute one of the most significant features of collective community effort and a community can often best be judged by the effectiveness of its institutions. Because the way these institutions are designed, built, maintained and operated affects the health and well-being of the many who occupy them, programs to insure maintenance of certain environmental standards are essential.

The mission of institutional environmental health is to protect beneficiaries, staff, and visitors at these institutions from any and all environmental factors threatening their health and well being. The nature of the program varies according to institutional status (private, volunteer, or public), involved governmental level (international, federal, state, or local), involved governmental department (corrections, health, social welfare, or education), legal status, and funding. Failure to recognize institutional uniqueness can cause great difficulties for managers of institutional environmental health programs.

CURRENT STATUS OF PROGRAMS

Several federal agencies set standards for institutions supported under their programs. These standards deal, at least in part, with environmental health factors. The Office of Education in the U.S. Department of Health, Education, and Welfare (HEW), sets guidelines and standards for elementary and secondary schools and colleges. The Public Health Service in HEW, the Federal Housing Administration in the U.S. Department of Housing and Urban Development and the Small Business Administration in the U.S. Department of Commerce establish and apply standards for design and construction of hospitals and other health facilities for which they supply financial support. The Social Security Administration and Social and Rehabilitation Services in HEW set and apply standards for services and mode of operation for institutions caring for patients under the Medicare and Medicaid programs.

Responsibility for inspection and initial determination of compliance under federal programs is usually delegated to appropriate state agencies, such as education and health. Most states have adopted laws and regulations of their own relating to health and safety of pupils, inmates and other occupants of institutions. These laws are usually enforced by the agency designated to operate the institution in that state, such as corrections, health, welfare, or education. States delegate inspection and compliance responsibilities to local counterpart agencies, where those agencies have sufficient capability. Otherwise the states perform on-site inspections and other required activities with their own staffs. In the private sector, the Joint Commission on Accreditation of Hospitals has established standards which it applies to hospitals and nursing homes seeking accreditation.

Because institutional environmental health programs exist at so many levels, a single facility may simultaneously be under the surveillance of federal, state, local and private systems operating to maintain all or part of the environmental health status of the institution. The more fortunate institutions have a director of environmental health to reconcile, coordinate, and supplement these activities into one totally effective system. All of the larger institutions should be encouraged to establish their own environmental control program to provide daily surveillance of environmental conditions.

PROBLEMS

Institutions are especially susceptible to environmental health problems because they are:

Preceding page blank

1. *Communal.* Persons of diverse economic and cultural backgrounds live and work together in institutions.

2. *Food Service Establishments.* In addition to the usual problems associated with food service establishments, many institutions provide food in resident rooms. (For further information on food sanitation refer to chapter on Food.)

3. *Difficult to Keep Sanitary.* Large scale occupancy by diverse groups (beneficiaries, staff, visitors) complicates environmental health efforts.

4. *Administratively Rigid.* Many institutions resist changes, even those which lead to improved environmental health.

Institutional environmental health programs encompass 7,172 hospitals (35 million admissions), 121,930 schools (57 million students), 406 penal institutions (387,000 inmates), plus numerous other institutions including those housing 470,000 aged and 73,000 neglected children. The inconsistency and incompleteness of available data on institutions make it impossible to determine precisely overall status from the environmental health point of view. There is evidence, however, that severe problems exist. For example, facility inspections performed under the Medicare program in 1968 and 1969 found that over 40% of hospitals and 50% of extended-care facilities inspected had deficiencies in physical environment. (Other chapters relating to environmental problems that may be associated with institutions are: Air, Water, Food, Drugs, Solid Waste, Vectors, Residential Injuries, Radiation, Occupational Health, Noise and Program Planning.)

OBJECTIVES

Institutional environmental health objectives may be stated in terms of impact on human health, such as:

1. To reduce the incidence of staphylococcus infections in hospital patients by X percent within the next year.

2. To reduce accidental injuries to prisoners and guards by X percent within the next two years.

3. To eliminate food poisonings attributable to school cafeterias during the next year.

Or, they may be stated in terms of reduction in hazard, such as:

1. To bring X percent of all schools into compliance with structural safety standards within three years.

2. To bring all hospital food service facilities into compliance with state sanitary standards within 18 months.

3. To bring all state penal institutions into compliance with fire safety standards within one year.

Action steps for meeting such objectives might include:

1. Conduct five courses on sterilization techniques for directors of sterile supply from 50 hospitals during the next year.

2. Perform fire safety inspections of 50% of penal institutions during the next six months.

3. Accomplish installation of adequate hallway and stairway lighting in five state university classroom buildings which do not meet illumination standards by next September.

4. Perform school cafeteria sanitation inspections and provide staff orientation in 75% of all schools in the system by June.

5. Design an incentive program for reduction of accidental injuries among prisoners within three months.

PLAN OF ACTION

Because institutions, especially the larger ones, tend to be complete, self-contained environments, an institutional environmental health program will be concerned with almost the total range of environmental problems. Water, sanitation, sewage, solid wastes, food, injury, vectors, ventilation and air pollution, noise, occupational hazards, general housing sanitation and radiation all are potential program responsibilities. The principal activities of a complete program will include:

SURVEILLANCE

Regular inspection of institutions for which the program is responsible comprises the central program activity. Such inspections can only have meaning when there are criteria and standards against which to measure the institution in terms of environmental health. Inspection reports should reveal institutions which do not meet environmental standards, and identify deficiencies. Inspections covering environmental health sometimes are conducted in conjunction with broader-scale inspections, as in the case of health facility inspections performed under Medicare and Medicaid, which also assess factors not related to environmental health.

CONSULTATION

Qualified program staff should review and evaluate, from the environmental health point of view, plans for construction and operation of facilities before such plans are implemented. In the course of and subsequent to inspection, they should provide guidance and encouragement in the correction of deficiencies. They can also perform, or arrange for, epidemiological investigations in cases of institutionally-related disease outbreaks.

TRAINING AND EDUCATION

In addition to guidance provided in connection with inspections, the program should conduct formal training courses for staffs and other occupants of institutions in order to improve knowledge and behavior in institutional environmental health.

COMPLIANCE

Depending on nature and location of the program, it may have anything from no authority to a substantial degree of authority to bring about compliance with applicable standards. Where the program is administered by the same governmental agency which operates the institutions or where the institutions are operated by a sister agency, compliance may be accomplished by administrative action of the agency head or chief executive of government. In other cases, pressures may be brought to bear by arranging for withholding of financial support or licenses. Sometimes, where legal authority exists, court action may be instituted.

Basic program staff, including a full-time director, should have backgrounds in environmental health. Because of the broad array of environmental problems with which the program will be involved, reliance will have to be placed on close working relationships with staffs of other environmental health programs in order to draw upon specialized expertise when required. For the same reason, the program will frequently concern itself with problem areas which are a legitimate concern of other programs and agencies, such as health facility planning or construction agencies, departments of public works, urban planning agencies, and almost all other environmental health programs. The closest cooperation and coordination is necessary to prevent overlapping and duplication of effort and to ensure commonality of purpose.

IMPLEMENTATION

LEGISLATION

Before a meaningful institutional environmental health program can be set up, there must exist laws and regulations covering construction, maintenance, and operation of institutions and providing authority for inspection and enforcement. Therefore, a first step will be to assess present legislation and to attain the enactment of needed laws and development of needed regulations.

ORGANIZATION

Although responsibility for certain kinds of institutions may be vested in other agencies, the focal point for environmental health in institutions should be the state and/or local health department. Counties that have well organized, fully staffed health units can carry on a comprehensive program involving all institutions located in their county. If institutions are located in areas where there is no county health department, assistance may be required from the state health department.

BUDGET

Money to operate a satisfactory program

usually comes from general health appropriations for all programs. Some programs operate on money collected from fees or licenses. Data to support proper funding should be obtained and presented in budget requests. Budget allocation should be provided for the salaries of personnel, travel, field and laboratory instruments, special manuals, books and professional journals and allowance for special consultation services.

EVALUATION

Program evaluation is based on a meaningful set of objectives and action steps, such as provided under "Objectives." Failure to accomplish objectives and action steps indicates that the program needs modification or that the objectives were faulty. Program evaluation should be carried out on a more or less continuing basis with in-depth program review and evaluation at least annually.

INJURIES

INTRODUCTION

Accidental injuries and deaths are a health and medical problem of cardinal significance. They are America's fourth greatest killer but the leading killer of persons 1-35. The establishment of effective injury control by state and local governments will reap benefits which can be measured in both human and economic terms. Accidental injuries and deaths occur in all socio-economic segments. However, they are disproportionately incurred by that segment which is least able to bear the financial and social consequences—the educationally, socially and medically disadvantaged. Each year the Nation bears witness to more than 113,000 deaths and 50,000,000 injuries. Many of these persons are permanently disabled by accidents which occur in the home, community, public places and recreational areas including streets and highways. Increased technology coupled with the demand for newer consumer products contribute to the annual injury toll. Americans—20 million of them—are injured each year in the home as a result of accidents connected with consumer products. Of the total, 110,000 are permanently disabled and 30,000 are killed.

Accidents destroy national economic and productive potential and every state or political entity shares in paying the cost. The consistent annual payments made by the Nation are reflected in these statistics: 132 million days of bed disability; 94 million days of work loss; an estimated $16 million for *direct* costs—not production losses, not family welfare, not insurance premiums, and not economic and family dislocations! In addition, any state or political entity faced with increasingly scarce medical resources must recognize the impact which injuries have in continually depleting this reservoir. Annually, injuries account for 100 million visits to private physicians; 80 thousand hospital beds for care and treatment; 200 thousand hospital personnel required for care and treatment of victims confined to hospital beds for an estimated 22 million days. Clearly, accidental injury is a deadly but preventable health problem. Injury control activities and accomplishments are related to many aspects of the community. What is developed and implemented within the community can affect the health and safety of the Nation. The cheapest thing to do about injuries is to prevent them.

MISSION

The overall mission of injury control programs is three-fold:

1. The recognition, prevention and control of accidental injuries by focusing upon the triad which occurs in any accident (human factors, agent, environment).
2. Preventing or minimizing the injuries resulting from accidents by improved environmental controls and increased citizen awareness.
3. Amelioration of the consequences when injuries do occur by improving emergency care, treatment, transportation and rehabilitation.

Significant improvements can be made in any state by focusing upon one of the above elements. However, since virtually every man, woman, and child in the Nation is a potential accident victim, only with sustained efforts in all three areas will truly great benefits be realized. Solutions to the problem will challenge every community and require a diversity of approaches and skills necessitating the cooperation of the whole community. As the mission is carried out, not only will specific problems be further delineated but also communication channels will be set up to establish an injury control program as a focal point and liaison for true comprehensive health activity.

FEDERAL ACTIVITIES

Although injury control efforts at the federal level exist in several administrative organizations, the principal injury control efforts emanate from the Public Health Service (PHS), U.S. Department of Health, Education, and Welfare (HEW). That program is the primary focal point for control programs to reduce accidental injuries caused by environmental situations and human behavior at the state and local level. Some of the categories which receive emphasis are carbon monoxide and lead poisoning prevention, burn prevention, recreational safety, occupational safety and pedestrian safety. Considerable emphasis is also placed upon developing statistical data on accidental injuries, conducting epidemiological studies and surveys, and developing health criteria for recommending injury prevention standards, technical assistance to state and local agencies, research on the behavioral aspects of accidents, scientific, technical, and public information services and short term training of local injury control personnel. Program activities include a research laboratory making studies of an individual's ability to detect and recognize hazards in his environment and protect himself from injury. The Food and Drug Administration (FDA), PHS, HEW, conducts its Product Safety Program under the regulatory responsibilities of the Hazardous Substances Act as amended, the Flammable Fabrics Act and the Public Health Services Act. The Federal Hazardous Substances Act as amended covers any household substance which is toxic, corrosive, irritant, sensitizing, flammable, radioactive, generates pressure, or is a toy or other children's article which is a hazardous substance or has any mechanical, electrical or thermal hazard. Under the Federal Flammable Fabrics Act, FDA is responsible for conducting investigations and studies of deaths, injuries and economic losses resulting from accidental burning of products or related materials. In addition, FDA maintains a central file of information for 560 Poison Control Centers throughout the U.S. The national clearing house provides data on the ingredients, toxicity, symptoms and findings and recommended treatment involving the more common household products and medicines likely to be ingested.

Other federal agencies having specialized safety programs are: U.S. Department of Agriculture (conducts research on safety of farm labor, farm machinery and farm structures. County extension agents promote safety in the home and on the farm and the Forest Service has extensive safety programs); U.S. Department of Commerce (develops standards for the flammability of fabrics, conducts research and development in the physical sciences, and prepares safety codes for use by cities, states and government departments or voluntary adoption by industry); U.S. Department of Labor (the Bureau of Labor Standards promotes industrial safety, gives technical help to state labor officials on accident prevention programs, drafts safety and health codes, and provides training courses for safety inspectors); U.S. Department of Transportation (charged with the responsibility of reducing accidental injuries related to various methods of transportation); U.S. Department of Housing and Urban Development (the Federal Housing Administration encourages improvement in housing standards with emphasis upon the structural safety aspects of residential environments). Other federal agencies or commissions having specialized safety programs include the Atomic Energy Commission, U.S. Department of the Interior, and the National Commission on Product Safety.

STATE ACTIVITIES

At the state level, responsibility for dealing with safety and health of the community is distributed among various agencies both official and voluntary. Although all states have some activities in this area, the scope of activities range from minimal effort to relatively sophisticated programs. In most cases, primary impetus comes from the administration of an injury control program by the state health department. Other agencies such as the department of agriculture, department of conservation, department of labor, and state fire marshalls, are vital supporting elements. More recently, the emergence of departments of consumer protection, such as that established in New York City, should provide even more concentrated attacks on accidental injuries.

LOCAL ACTIVITIES

Presently, relatively few local health departments have established formal injury control programs. Only .59% of available local health department man hours are devoted to accident control activities.

PRIVATE SECTOR ACTIVITIES

Private industry has a major stake in injury control and through the years has exerted considerable effort to protect employees from incurring on-the-job injuries. Evidence of this is reflected in a decline in industrial accident rates due to rigorous employee selection and training, provision of protective devices and safer mechanical equipment and improved working conditions. Although industry still has far to go, most political entities could profit from its methods. On those occasions where considerable liaison has existed between government and the private sector, evidence exists that manufacturers are willing to redesign or remove from circulation items which are proven to be hazardous. Such joint efforts have resulted in the development of: tempered safety glass for doors and panels; flame retardant fabrics for clothing and home furnishings; improved heating pads; non-lead based paint for residential interiors; removal from the market of gas heaters with defective design; refrigerators with door assemblies designed to prevent accidental child entrapment; items for increasing pedestrian nighttime visibility, and many others. Progressive industry leaders recognize that injuries occur more frequently in the employee's recreational and living environment than at work, and that preventing all injuries is sound business. Since industrial employee groups constitute controlled populations an excellent opportunity is available for state and local government to promulgate safety education programs in order to prevent off-the-job injuries. (See chapter on Occupational Health for additional information on occupational injury hazards.)

PROBLEMS

In the development of an Injury Control Program many problems emerge which are peculiar to the state and local government attempting to implement the program. The following examples of problem areas are not intended to be all-inclusive, but only suggestive. The extent to which they will apply to a specific jurisdiction will need to be determined.

ADEQUATE MORBIDITY AND MORTALITY DATA

Quantitative information on risk level and nature of accidental injuries is basic to defining the injury control problem of the community. However, there are tremendous gaps in the availability of such information throughout the Nation.

RESOURCES

Over the years very limited funds have been available at the state and local levels of government for activities related to injury control. Because of this, very limited manpower (part time and full time) has been devoted to injury control in state and local public health agencies.

COMPLEXITY AND SCOPE OF INJURIES

Deaths and injuries occurring each year result from a wide variety of circumstances. In many cases the human element appears to be the primary factor. In others, certain environmental conditions appear to predispose individuals to accidental injuries. Increased technology is also a contributor by placing seemingly innocuous products in the market place.

To be more specific, an understanding of the following, a four pronged approach, is basic to an effective program.

1. *Injury Surveillance.* This activity will provide most of the basic information necessary to describe the nature and extent of the problem regarding specific injury categories and associated environmental hazards, identify target populations and provide an alert mechanism to new and emerging injury-causing situations.

2. *Epidemiology.* Surveillance information needs to be supplemented in many cases to provide a clearer understanding of the injury producing events. Specific cause and effect relationships can be determined through in-depth investigations of selected accidents.

3. *Determining and Enforcing Existing Legislation.* Many states already have effective legislation to combat accidental injuries. Such legislation runs the gamut from codes for unvented space heaters to the safe storage and handling of flammable liquids. Unfortunately, the enforcement of effective legisation is at times lacking at many levels of government. An assessment of existing legislation as well as more concentrated enforcement will go far in reducing accidental injuries within any state or local government.

4. *Establishing Effective Information and Education Programs.* The successful attack in accidental injury problems must inevitably be based on three essential elements: modifying hazardous environments, improving hazardous agents (consumer products), and modifying human behavior. Considerable evidence exists that more control of accidental injuries is possible through more vigorous applications of improved educational programs by local, state and federal governments.

OBJECTIVES

Long range objectives are:

1. To assure a safe and healthful community environment.
2. To effect a reduction in the number and severity of injuries occurring within the community.

Specific objectives vary geographically state by state or by areas within a state according to the extent of the problem, climatic conditions, cooperative working relationships with other agencies, availability of resources and capabilities of the staff. Whenever possible, objectives should be stated in quantifiable terms. For example, an objective simply stated "to reduce deaths from burn injuries in the community" has little meaning. First, one is not aware of the present position in relation to the objective. Secondly, the target group to be effected is missing. Thirdly, no attempt is made to project the point to be reached over a specified period of time. Much more meaning is obtained if the objective reads "to reduce deaths from burns among children, ages 1–10 from the present 200 annual deaths to 100 by calendar year 1971." Health objectives are set so that progress toward them might be achieved systematically and with maximum efficiency and effectiveness. They should be viewed as dynamic rather than nebulous or inflexible statements.

Using the criteria above, a political entity moves from the realm of long range objectives to the establishment of operational or short range objectives. Such objectives reflect what can be reasonably accomplished in a short period of time (12–18 months) toward the attainment of the long term goals. Some suitable short-range objectives, depending on the individual situation, might include the following:

1. Identify all major injury control problems in the area of jurisdiction by end of current fiscal year.
2. Establish an adequate reporting system on injuries at out-patient departments in hospitals representing 25% of hospital beds in jurisdiction within two years.
3. Develop and secure adoption of building codes throughout the jurisdiction requiring tempered glass (for sliding glass doors, panels, shower doors, etc.) by end of current fiscal year.
4. Develop understanding of injury control techniques (through formal training courses) in 50% of employees of official and voluntary health agencies in jurisdiction, during next fiscal year.
5. Reduce accidental injury rates within model city area by 10% within two years.

The establishment of priorities for injury control must be determined on an individual basis. Generally, such a determination is based upon population groups affected, incidence, severity and emerging trends. In addition, the carrying out of priorities will depend upon resources available, legislative and political mandates and the policies of the department under which the injury control program operates.

PLAN OF ACTION

In the plan of action for injury control the administrator brings into play all available knowledge and skills in setting forth operational methods whose execution will assure maximum results. Major attention is given to the development of program activities and the resources available to meet previously determined problem areas. Constraints upon program development should receive early attention as well as the relationship of the injury control program to other agencies and groups.

The following sections describe briefly some of the above areas and are flexible and general enough that most states or political entities can adapt them to their individual situation.

PROGRAM ACTIVITIES

Provided reasonable resources are available and constraints are not such that they totally negate any injury prevention efforts, the types of services which an injury control program can provide are extensive. The following activities are not all inclusive but are representative of some states' and local governments' injury control efforts. They are offered as examples that can be included in a plan of action.

1. *Community Profile.* Basic to any plan is a comprehensive analysis of the locality. Planning should begin with the identification of high risk groups, mortality and morbidity data, potential data sources, legislative status and needs, and community resources.
2. *Survey.* A short analysis or inspection of the community can be beneficial in collecting basic information on potential injury hazards and methods of control.
3. *Epidemiology.* Once a state or local program has been established, a system of professional investigation (epidemiology) should be set up in order to identify more precisely the host, agent, environment relationship of accidental injuries.
4. *Consultation.* Consultative services on prevention and control of accidental injuries should be offered to various community organizations, including schools, hospitals, parent-teachers associations, medical associations, private industry, and others.
5. *Codes and Ordinances.* A determination should be made of the presence and adequacy of codes and regulations as a means to promote and/or upgrade legislation (this could be part of the community profile or undertaken as a separate function).
6. *Follow-Up.* Once appropriate legislation has been identified and enforcement procedures are outlined, followup visits are necessary to determine compliance with recommendations for improvement or control of health hazards.
7. *Educational Activities.* The development and distribution of program materials (visual aides, radio and TV spots, news releases, etc.) are types of assistance that can be offered to the community and professional groups.
8. *Establish Working Relationships.* In the interest of channeling efforts, a cooperative working relationship should be established and maintained with other official and voluntary agencies such as state departments of labor and agriculture, state fire marshalls, industrial safety commissions, and state comprehensive health planning agencies, on matters pertaining to injury prevention within the community.
9. *Citizen Participation.* Any injury control program should provide for the active participation and advice of residents in defining special injury control problem areas and assisting in the solution when appropriate. Citizen participation is effective when the residents of the community can individually and/or

collectively involve themselves in such programs as removing old refrigerators from the premises, clearing playgrounds of hazardous materials, informing their neighbors of the dangers of lead poisoning from flaking paint, and many others.

CONSTRAINTS

The following constraints are representative of many injury control programs at the National, state and local level of government.

1. Lack of quantitative data on the nature and extent of the injury problem. Lack of such data includes degree of injury, frequency, and causative agent.
2. A serious shortage of fiscal resources and trained manpower to carry out programs.
3. Complex and constantly changing nature of specific environments, i.e., industry, home recreational and highway.
4. Inadequacy or absence of legislation and regulations.
5. Lack of established analytical methodology and laboratory expertise to determine hazardous attributes on a quantifiable basis.
6. Lack of coordination of injury control activities within the community.
7. Lack of leadership and/or commitment to injury prevention.

RELATION TO OTHER PROGRAMS

In most health programs the extent of interfacing can be fairly well defined. Injury control programs are not as simplistic; generally program activities prevade throughout the spectrum of public services and particularly within the field of environmental health. As an example, statistical information on the injury problem tells us that the most frequent causes of disabling or fatal injuries in sequential order are: motor vehicle accidents; falls, burns; poisonings; drownings; and firearms. If we only consider the above, we find that there is an interface with many existing services. Motor vehicle accidents, for example, has an inter-acting relationship with agencies involved in highway planning, traffic control planning, drug and alcohol addiction, law enforcement, transportation, physical and mental health, recreational safety, as well as many others.

A brief look at the problem of falls also reveals an extensive interface when we consider implementing a preventive program. Such groups as housing, waste disposal, recreation, drug and alcohol addiction, architects, safety commissions for employee protection, as well as many others, can and should be called upon to assist in developing a preventive program.

It is impossible, therefore, to suggest any singular group which a state or political entity could attempt to cultivate first or most extensively. This decision must be an individual one which takes into consideration past experiences, the political climate, and the extent to which an injury control program is to be implemented. Some suggested agencies and groups which have contributed extensively to injury control efforts in the past are department of housing and community management, department of agriculture, department of labor and migrant worker groups, occupational health, nursing and educational institutions.

THE FINAL PLAN

The major combinations or mixes of activities which could comprise alternative plans for an injury control program are determined by the extent of the identified problems and the established objectives and priorities. Priority setting and subsequent decision making can best be done if the program administrator makes full use of the basic concepts of the program and has before him information on the unmet needs and available resources. Alternative plans should then be examined in terms of their relative potential effectiveness. Substantial consideration should be given to the immediate cost of carrying out certain programs, future costs and what the anticipated future trends indicate. Normally, sustained effort should be directed toward reducing injuries in problem areas where they have been occurring over the years. Undue attention (except initial education activities) to "fads" and "gimmicks" do little to strengthen an effective injury control program. Alternative plans should also be examined in terms of public acceptability and other constraints. The alternative which appears to be most effective and feasible to attain is recommended for final action. With the current emphasis on system analysis, cost-benefit analysis and the desire for quantification of effort, very few health programs can offer such measurable results as an injury control program. Any administrator confronted with decisions on the allocation of resources would do well to seriously consider his alternative programs in light of the impact which reducing injuries has on the whole economic and social structure of the community.

IMPLEMENTATION

The implementation of an injury control program within any political entity is quite flexible. It should be done within the context of basic management techniques, resources and personnel availability, and a realization that change brings resistance. So long as the basic elements are put together in a workable and logical fashion the likelihood of smooth implementation is increased. The final pattern of implementation may vary in each state or political entity, and this is both desirable and feasible. Consideration should be given to these basic elements: organization, personnel, training, budget, and legislation.

ORGANIZATION

Responsibility for coordinating and directing the implementation and conduct of an accidental injury control program should be placed in one administrative unit. Organizationally, the unit should be placed where it can function as coordinator for the many disciplines whose responsibilities include one or more aspects of injury control. In some health departments, this has been accomplished by the establishment of a position or a separate administrative unit directly under the supervision of the health officer. In other health departments, the responsibility for this program has been placed in such existing administrative units as environmental health, health education, or maternal and child health. It has been observed that when responsibility is placed in such administrative units there is difficulty in coordinating the program and a tendency to narrow the focus of the program to an area where the responsible individual is most knowledgeable. In any event, an active participating inter-disciplinary planning committee with representation from other public health programs is certainly desirable and can be very helpful in developing a well-rounded and continuing program. Organizationally, an injury control program can be based in environmental health bureaus or divisions in the department of health. More recently injury control programs are being developed as a separate administrative unit of the health department and combine many aspects of preventive programming, including emergency medical services, occupational health, traffic safety and consumer protection.

PERSONNEL

A broadly based program requires representatives of many disciplines including physicians, nurses, epidemiologists, scientists, statiticians, economists, engineers, sanitarians, and supporting auxiliary staff. For an effective minimum injury control program, staff should include at least one administrator, well trained in injury prevention activities, one full time field epidemiologist, a health educator, and at least one secretary-stenographer. In the medical services area, a nursing consultant would be particularly beneficial to an injury control program. Her major task would be to work with members of the community (parents and children especially) during her regular visits. A physician, at least on a consultant basis, should be available for assistance with medical problems especially relating to potential trauma and toxicity of product related injuries.

TRAINING

In the development of injury control programs, it is essential that in-service training be provided for the personnel involved in injury control activities. Training should include the professional staff of the department including persons involved in personnel, environmental health services, school programs, children's services, and other community activities. The opportunities for training in injury control are relatively good. PHS periodically provides training courses lasting from one day to two weeks for injury control personnel. Many state agencies likewise sponsor one or two week training courses for various disciplines either alone or in cooperation with PHS. Some universities also offer similar short courses lasting one or two weeks.

Recently, an innovative approach to compensate for the lack of trained manpower has been attempted by the use of health aides in conducting injury control activities. Under proper supervision such persons can be most helpful in conducting injury control activities. Recruitment can come from qualified junior college or high school graduates in inner city and rural areas. Others may simply be residents of the inner city and possess an unusual grasp of the approach and manner in which a particular program should be conducted.

BUDGET

Considerations for budget allowances in state or local injury control programs are similar to most other budgetary requests. Specific identification of salaries, travel, specialized equipment, books and professional journals, and development of program tools would be normal considerations.

LEGISLATION

This will need to be determined by the individual state or political entity and take into account existing legislation, and the legislative responsibility of other state agencies concerned with the safety aspects of the community. Model legislation for a number of injury control activities is available from PHS.

EVALUATION

An injury control program evaluation is meaningful only to the extent that it relates to progress made toward stated objectives. Normally, progress should be stated in quantitative terms and stress the impact program activities have made on the problem. Any meaningful evaluation would indicate the appropriateness (whether the objectives are important), adequacy (whether objectives are too grandiose or understated), effectiveness (whether the objective is reached), and efficiency (whether cost is excessive) of the programs as measured against stated objectives.

The most common public health indicators of impact are changes in injury disability and death rates. The indirect indicators most easily obtainable are activity measures, but these activity indicators may have little or no relation to progress toward realization of the stated goals. Detailed reports on number of talks given, man hours expended in demonstration, number of conferences attended, number of students "educated" in short courses, are not in themselves indicators of an effective injury control program. They are instead a means of obtaining the objectives, or they relate to the objective indirectly. They are necessary, however, to evaluate the means and tools being used to achieve objectives. It would be entirely possible to conduct a program for several years, utilize countless man hours and unlimited money on the basis of "intuitive" feeling that so much good information disseminated to the public must be a "good thing" and thereby have prevented untold accidents and alleviated limitless misery. This may well be true, but until you are able at some point to demonstrate beyond reasonable doubt that the decrease in deaths and/or injuries is attributable in some measure to your programs you will have difficulty in assuring continuous funding.

Normally, the evaluation process of an injury control program is a continuous activity. As a minimum, however, an intensive review should be made semi-annually. Most evaluations of the program efforts will reveal imperfect success in attaining objectives. This is probably most desirable since the purpose of program evaluation is also to pinpoint areas where problems exist. A program may be less effective than planned for a variety of reasons. Perhaps resources were not available to use as planned; initial assumptions on linking activities to program activities were invalid; personnel were not made available; community acceptance was minimal, as well as many other variables. Oftentimes planners view the evaluation process as one of the most difficult aspects of program development. Yet, if rigorous analysis goes into the definition of the problem, establishment of quantifiable objectives and a feasible plan of action, the evaluation process is the insurance factor which gives personal satisfaction and confidence that previous decisions on the prevention of injuries in the community were, in fact, wise decisions.

OCCUPATIONAL HEALTH

INTRODUCTION

Benefits of an effective occupational health program can be stated in both human and economic terms. To begin with, delivery of preventive and emergency health services at the site of employment effects economies and efficiencies that general community and curative health services are unable to realize.

Every state or other political entity has its share of occupational health and safety failures and pays its share of the cost. Hazards occur in all types of industry such as manufacturing, mining, agriculture, construction, service trades, utilities, and government. Nationally, some 14,500 workers are killed annually while at work. Another 2,200,000 incur disabling injuries related to their work. Workmen's compensation costs for occupational accidents and diseases alone amount to some $2 billion per year. These are sketchy but significant indications of the enormous potential for human and economic savings that can be achieved through occupational health and safety programs. In addition, occupational health activities and accomplishments are related to many other aspects of the community. What is learned and practiced in the factory or other workplace can constructively affect related environmental health services, and several other areas of human health and well-being.

MISSION

The mission of occupational health is three-fold (1) recognition, prevention and control of occupational health hazards and illnesses through the improvement of the working environment; (2) promotion of good health and well-being among workers through provision of health services at the work site; and (3) extension of public health services to the employed members in the community. The target population is the entire work force of over 80 million. About 75 percent of those employed work in approximately three million small industries, businesses and farms with less than 500 workers each, which with few exceptions, provide little or no preventive health services.

Environmental control of occupational health and safety hazards at the workplace is only one facet of comprehensive occupational health. Another important facet, preventive health maintenance of workers, is (with few exceptions) a neglected area in state and local occupational health programs.

Social and economic implications of occupational health emerge with increasing clarity as we become more aware of the tremendous cost (to industry and the Nation) of disease and absenteeism in the work force. And many other health and related problems such as chronic diseases, mental and emotional stresses, alcoholism, genetic and nutritional deficiencies, social or ethnic incompatibility, high costs of medical care, and poor housing continue to be barriers to gainful employment. All of these problems are related to or may interact with occupational health interests. The solution to these and other problems requires various approaches and skills, and the cooperation of the total community. The occupational health agency can serve as a spearhead and liaison for many public health services available within the health department and community health agencies; and the workplace can be a focal point for delivery of such services.

FEDERAL ACTIVITIES

The principal occupational health program of the federal government is located in the Public Health Service (PHS), U. S. Department of Health, Education, and Welfare. That program encompasses epidemiological studies of suspected health hazards in specific types of industries; development of occupational health criteria and standards; research on toxic substances used in industry; development of improved analytical and field sampling methods; technical assistance to state and local agencies; scientific, technical, and

Preceding page blank

OCCUPATIONAL HEALTH

INTRODUCTION

Benefits of an effective occupational health program can be stated in both human and economic terms. To begin with, delivery of preventive and emergency health services at the site of employment effects economies and efficiencies that general community and curative health services are unable to realize.

Every state or other political entity has its share of occupational health and safety failures and pays its share of the cost. Hazards occur in all types of industry such as manufacturing, mining, agriculture, construction, service trades, utilities, and government. Nationally, some 14,500 workers are killed annually while at work. Another 2,200,000 incur disabling injuries related to their work. Workmen's compensation costs for occupational accidents and diseases alone amount to some $2 billion per year. These are sketchy but significant indications of the enormous potential for human and economic savings that can be achieved through occupational health and safety programs. In addition, occupational health activities and accomplishments are related to many other aspects of the community. What is learned and practiced in the factory or other workplace can constructively affect related environmental health services, and several other areas of human health and well-being.

MISSION

The mission of occupational health is three-fold (1) recognition, prevention and control of occupational health hazards and illnesses through the improvement of the working environment; (2) promotion of good health and well-being among workers through provision of health services at the work site; and (3) extension of public health services to the employed members in the community. The target population is the entire work force of over 80 million. About 75 percent of those employed work in approximately three million small industries, businesses and farms with less than 500 workers each, which with few exceptions, provide little or no preventive health services.

Environmental control of occupational health and safety hazards at the workplace is only one facet of comprehensive occupational health. Another important facet, preventive health maintenance of workers, is (with few exceptions) a neglected area in state and local occupational health programs.

Social and economic implications of occupational health emerge with increasing clarity as we become more aware of the tremendous cost (to industry and the Nation) of disease and absenteeism in the work force. And many other health and related problems such as chronic diseases, mental and emotional stresses, alcoholism, genetic and nutritional deficiencies, social or ethnic incompatibility, high costs of medical care, and poor housing continue to be barriers to gainful employment. All of these problems are related to or may interact with occupational health interests. The solution to these and other problems requires various approaches and skills, and the cooperation of the total community. The occupational health agency can serve as a spearhead and liaison for many public health services available within the health department and community health agencies; and the workplace can be a focal point for delivery of such services.

FEDERAL ACTIVITIES

The principal occupational health program of the federal government is located in the Public Health Service (PHS), U. S. Department of Health, Education, and Welfare. That program encompasses epidemiological studies of suspected health hazards in specific types of industries; development of occupational health criteria and standards; research on toxic substances used in industry; development of improved analytical and field sampling methods; technical assistance to state and local agencies; scientific, technical, and

Preceding page blank

public information services; and short-term training of occupational health personnel. The U. S. Department of Labor (USDL) administers the Walsh-Healey Public Contracts law and related Acts governing health and safety of workers in plants with government contracts. USDL also administers the Federal Employee's Compensation Act applicable to Federal civilian employees, and the Longshoremen's and Harbor Worker's Compensation Act which covers private maritime employment on navigable waters in the United States. The Civil Service Commission has responsibility for promoting development of health and safety services for workers in the various federal departments. The U. S. Department of the Interior through the Bureau of Mines is responsible for health and safety of workers in the coal, metal and nonmetallic mining industries. Other federal departments also maintain occupational health services for the protection of their personnel.

STATE ACTIVITIES

At the state level, responsibility for dealing with safety and health of the workforce is dispersed among various agencies. Programs dealing with industrial hygiene aspects of the working environment are administered by state health departments in most states, and in a few, by state departments of labor. Scope of activities range from minimal to relatively sophisticated. In several states, such activities are absent altogether. Industrial accident commissions may also have limited functions in these areas. Safety and accident prevention activities in industry and commerce are almost entirely functions of state labor authorities. Accident prevention in mines may be a function of state departments of labor or departments of mines.

LOCAL ACTIVITIES

To date, relatively few local health departments have established formal occupational health programs. The role that they can play in bringing to workers preventive health services through the utilization of existing staff such as the sanitarian and public health nurse is discussed in "Local Health Official's Guide to Occupational Health." This pamphlet also describes the kind of occupational health services a local health agency can provide with trained industrial hygienists.

PRIVATE SECTOR ACTIVITIES

Many major corporations maintain their own medical departments. Services vary and may cover all or some of the following: emergency treatment of injuries and illness, preplacement and periodic physical examinations, health education and counseling services, rehabilitation services and safety and industrial hygiene. Such services are available to about 25 percent of the workforce in about one percent of the 3,500,000 workplaces in the Nation. Because of the high cost, most plants with 500 or less workers do not provide even minimal services and must depend upon public agencies for assistance with health and safety problems. Some labor unions have established their own medical and hospital insurance plans and pre-paid clinics. Insurance companies underwriting workmen's compensation provide consultation to plants they insure on prevention and control of occupational safety and health hazards.

PROBLEMS

NEED FOR INFORMATION

1. *Size and Composition of the Labor Force.* Data on number of workers and establishments, and employment-size of establishments by detailed industry groups for counties and each state as a whole, are published periodically in County Business Patterns. Such data are basic to any plans for establishing or broadening the present scope of occupational health programs, and in determining resources needed for action. The more highly industrialized the area, the more diversified will be the health problems associated with work. A major factor is the number of small workplaces. In these, preventive health and safety services must depend upon governmental agencies for assistance.
2. *Workplaces in need of Industrial Hygiene Assistance.* Surveys conducted by PHS indicate that three out of every four workplaces are in need of industrial

hygiene evaluation and control efforts. This ratio applies to manufacturing, transportation and public utilities, wholesale and selected retail trades and services. It can be extrapolated to other similar groups of industries. In those jurisdictions where industrial hygiene services have been absent or minimal, the proportion in need of assistance is greater. The need and demand for help with problems is likewise evident from the fact that a number of state agencies with active programs are so busy complying with requests for "fire-fighting" that they are rarely able to do any self-initiated work such as pre-planning to avoid health problems before they occur and promotion of preventive public health services in industry through community agencies.

3. *Prevalence and Incidence of Occupational Diseases.* Quantitative information on risk, level, and nature of occupational diseases and illness is basic to defining health problems of workers as well as to program planning and program evaluation. However, there are tremendous gaps in availability of such information throughout the Nation. Reasons for this situation include lack of uniformity in state reporting and in workmen's compensation laws, and absence of acceptable and uniform standards for reporting systems, definitions, and coding and tabulating procedures. Prevalence and incidence of occupational diseases are not accurately known. Compensation data on occupational diseases are available in about one-half of the states. The data are incomplete, in that they reflect provisions of compensation laws rather than actual prevalence or incidence. They do serve as a useful gross indicator of major trouble areas. The absence of quantitative data on occupational diseases in a specific jurisdiction should not deter planners from engaging in occupational health activities. Rather it should be seen as an opportunity to build an optimal occupational health program. Considerable knowledge exists on the kinds of occupational diseases and potential health hazards that are associated with specific occupations and industries and that can be used as guidelines in setting up priorities. A useful reference is "Occupational Diseases, A Guide to Their Recognition."

CATEGORIES OF HEALTH HAZARDS

As a rule, occupational skin diseases are the most prevalent of occupational diseases; pneumoconioses are the most costly from the standpoint of workmen's compensation; occupational poisonings continue to persist despite the existence of knowledge for controlling them. Occupational health hazards to which workers may be exposed are usually classified as:

1. Toxic chemical agents such as solvents, dusts, gases, metallic compounds, plastics and synthetic resins, and pesticides.
2. Physical agents or energy stresses such as excessive noise, temperature extremes, vibrations, pressures, and laser, ultraviolet and ionizing radiations.
3. Biological hazards such as infectious agents and enzymes.
4. Other work-related stresses such as rigors of work process, equipment design, workplace layout, relationship between capabilities and tolerances of the individual worker and the demands and stresses of the job. Ergonomics* is a relatively new approach to solving these other health problems of workers. This new science promises to be of major assistance to the industrial hygienist, augmenting his present activities in the measurement of physical and chemical stresses. To date, these other problems are being recognized but the criteria for predicting the capability of the individual to meet the demands and stresses of the job without jeopardizing his health still need to be developed.

---

* Ergonomics is the science of adapting work to the anatomical, psychological, and physiological capacities of man.

OBJECTIVES

Overall goals are to assure a safe and healthful work environment and to promote provision of basic preventive health services for workers in all places of employment.

Specific objectives vary state by state depending on the stage of development of the occupational health program, the predominant type of health hazards associated with industries in the state or area, availability of personnel, laboratory and field equipment, funds for travel, the scientific capabilities of the staff, and cooperative working relationships with other agencies. Suitable objectives, depending on the individual situation, might include the following kinds—each to be completed within a stated time.

1. Identification of all major occupational health problems in the area and location of the industries in need of help.
2. Elimination or reduction to a specified level of health hazards in specific industrial segments such as noise in machine shops, silica exposures in storage battery plants.
3. Promotion of part-time nursing services in a specified number of small industries in cooperation with local health agencies.
4. Conduct of a specified number of orientation courses in industrial hygiene for local sanitarians.
5. Implementation of specified occupational health services in specific Model Cities programs.

Priorities must be determined on an individual basis and will be governed by resources available for carrying on the functions, legislative and political mandates, policies of the department under which the occupational health unit operates, and the emergence of new health hazards created by continuously changing technology.

PLAN OF ACTION

Development of industrial hygiene programs in state and local governments is based on the premise that corrective measures in industry for the protection of the health of workers are accomplished largely by private effort and funds. The official agency must see that compliance with standards and regulations is accomplished, and must discover and point out to industry how to solve its own occupational health problems. The industrial hygienist must be quite familiar with industrial processes in order to recognize the existence of adverse health stresses. He must know the general effect of these stresses on man's health, and more important, he must know practical and economic ways to reduce or eliminate them. Moreover, he cannot work without the tools of his trade: expensive instruments, and a specially equipped and staffed laboratory.

CONSTRAINTS

In addition to the industrial hygienist's lack of proper equipment, the following constraints are national in scope, and apply in varying degrees at the state and local level:

1. Lack of quantitative data on occupational diseases, nature and extent of health hazards, and general health problems of workers.
2. Shortage of manpower in all areas of occupational health including engineers, chemists, physicians, nurses, scientists, and technicians for work in official agencies and in private industry.
3. Lack of funds for carrying out programs at state and local levels.
4. Lack of uniform rules and regulations concerning occupational safety and health, and a mechanism for implementing these rules and regulations at the state and local levels.

PROGRAM ACTIVITIES

Given reasonably adequate resources and freedom from constraints, the types of services which the occupational health agency can provide, alone or in cooperation with other groups, are extensive and will depend upon the agency's resources and occupational health problems in the area. The following functions are not all-inclusive, but are being carried out to a lesser or greater degree by currently operating occupational health agencies. They are offered as examples of functions that can be included in a plan of action. Items 1-12 are environmental, and 13-21 clinical.

1. Basic to any plan is an occupational profile of the locality. Planning starts with collection of data on the size of the workforce and types and locations of industries, prevalence of occupational diseases and injuries, and community resources. The latter includes management and labor groups, industrial development agencies, chambers of commerce and medical societies.

2. A preliminary survey of industries can be used to collect basic information on potential health hazards and their control, availability of preventive health services to workers, extent of safety activities, adequacy of sanitation facilities, housekeeping practices, general ventilation and illumination. Frequently, advice on control of obvious hazards can be offered on the spot. Names and addresses of companies can usually be obtained from state employment security agencies, from lists of companies published by chambers of commerce, or even from yellow pages of telephone books. Preliminary surveys are especially recommended for those states and areas that at present have only limited occupational health programs (or none at all) in order to identify workplaces in need of immediate attention.

3. Once a state or local program has been established, a system of routine and periodic surveys of workplaces must be established to identify hazards and plan for their control. Such periodic surveys require the collection of air samples for contaminant control and materials for laboratory analysis, quantitative evaluations of exposures to contaminants, and field measurement of noise, vibration, ionizing and non-ionizing radiation, heat, extremes of pressure, illumination, and ventilation.

4. Supportive laboratory services must be arranged to permit analyses to determine the degree of the health hazard to which workers were exposed. Examination of materials used at work will determine whether they contain substances dangerous to health. Examination of blood and urine for chemicals can determine the extent of worker exposure.

5. Followup visits or resurveys are necessary to determine compliance with recommendations made for improvement or control of health hazards.

6. Professional investigation of reported or suspected occupational diseases with recommendations for elimination or control of causative agents can prevent their recurrence. Copies of employers' and/or physicians' first reports of occupational diseases on a selective basis are generally available to occupational health agencies upon request from labor departments or workmen's compensation agencies.

7. Consultative services on prevention and control of occupational exposures should be offered to employers, physicians, nurses, contractors, and others.

8. Review and examination of engineering plans can insure installation of proper environmental control measures.

9. Preparation and distribution of information sheets and health education materials can further assist employers and employees.

10. Maintenance of adequate records and reports, including lists of new industries coming into the area, is essential to the smooth operation of a program.

11. In the interest of eliminating duplication or overlapping of services, cooperative working relationships should be established and maintained with other official agencies such as state departments of labor, mine inspectors, state fire marshals, and industrial commissions on matters relating to health and safety at the workplace.

12. Writing of needed or improved and updated regulations governing health and safety at the workplace or providing assistance to the agency authorized to promulgate such rules and regulations

should be routine functions of the occupational health agency.

13. Provision of medical consultation to management, labor and private physicians on recognition and diagnosis of occupational diseases.

14. Securing cooperation with medical society and individual physicians in the stimulation of proper preplacement examinations in industry.

15. Establishing medical consultation in industry regarding health services for in-plant medical departments.

16. Promoting nursing services in industry and nursing consultation to plant nurses on improvement of health services, or to first aid workers regarding emergency first aid procedures.

17. Development of cooperative preventive health services for workers in small plants.

18. Establishment of employee health services for governmental workers in state or municipal jurisdictions.

19. Provision of consultation to community health agencies regarding extension of public health services to working population and assistance with their implementation.

20. Maintenance of liaison with public health nurses to coordinate delivery of home nursing care for ill and injured workers and their families.

21. Participation in joint medical and environmental studies of workers exposed to specific health hazards.

RELATION OF OCCUPATIONAL HEALTH TO OTHER ENVIRONMENTAL HEALTH PROGRAMS

Because of the special skills and knowledge of industrial hygienists, advice and assistance can be given with a view to prevention of ancillary problems such as those associated with toxicology, including lead poisoning in children from toys and paints, unrestricted sale of dangerous economic poisons and agricultural chemicals, and carbon monoxide episodes. Technical assistance can be given to Poison Information Centers. Precautionary labeling of dangerous household products can be arranged. Use of dangerous or unhealthful materials in schools can be prevented. Investigations of complaints associated with indefinite environmental sources such as leaking refrigerators and sewer gas can be carried out.

Before Congress passed legislation in the areas of air pollution control and radiological health, the occupational health aspects of these programs were considered responsibilities of state and some local occupational health agencies. Currently, about one-half of the state occupational health units still have responsibilities in one or both of these areas, ranging from provision of laboratory services, monitoring of air and fallout materials, and studies of community air pollution in collaboration with other agencies, to full direction of both community and occupational aspects. A number of state occupational health units have been designated as the official state agencies in one or both of these areas with responsibility for full operation of the programs and enforcement of state regulations. Much of the field and laboratory equipment used by occupational health and air pollution control specialists is the same. Cooperative working agreements of an informal nature exist between a number of state occupational health units and state labor authorities regarding reciprocal referrals of safety and health problems encountered during routine inspection of workplaces. In many states, informal arrangements exist whereby the state department of labor or the workmen's compensation agency refers occupational disease reports or claims for compensation to the occupational health unit for their information and investigation. In some states the working relationship is spelled out by statute on such such matters as investigations of workplaces at the request of the state labor agency, and cooperation in writing of regulations to be promulgated by the state department of labor. The practice of occupational health interfaces with many of the other environmental health components of the official agency.

1. *Sanitary Engineering.* Here the concern is with disposal of industrial wastes,

proper water supply in the plant, cross-connections, and trace elements in water.

2. *Solid Wastes.* Occupational injury rates and the potential for occupational diseases among solid waste workers are among the highest in this country. In many communities, solid waste management is a municipal function. In all communities, it is at least a quasi-public function. Thus, particular care should be paid to governmental and non-governmental employees in solid waste management.

3. *Community Hazard and Accident Control.* Off-the-job accidents are a major cause of absenteeism among workers. Material that is taken home from the workplace—chemicals, solvents, dyes, power tools, etc.—present specific safety and health problems outside the work area. The problem of safe and rapid transportation to and from work must also be considered, as well as the effects the work environment may have on driving.

4. *Housing and Community Environmental Management.* Many of the employees from the inner city or hard-core poverty areas bring disabilities to the workplace which are directly attributable to their home living conditions. Interface with those municipal agencies concerned with house renovating, zoning, planning, Model Cities activities, and the employability of the inner city dweller is necessary.

5. *Food and Nutrition.* Nutrition becomes important in the job environment from the point of view of the availability of food that is wholesome and hazard-free. It is quite likely that proper food is available to some groups of people only through the workplace.

6. *Vocational Classes.* Of importance here is the inclusion of industrial hygiene concepts in the course content of vocational classes in schools. Protection of the school workshop environment is a proper function of the occupational health unit.

THE FINAL PLAN

The various combinations of activities which comprise alternative plans for occupational health are determined in light of identified problems and established objectives and priorities. Alternative plans are examined in terms of their relative potential effectiveness, the resources likely to be available, public acceptability, and other constraints. The alternative which appears to be the most effective that is also feasible of attainment is recommended for final action. When approved, this action plan defines the content of the program to be implemented and sets the resource requirements.

IMPLEMENTATION

No rigorously prescribed scheme for implementation of an occupational health program is feasible or desirable. Obviously, carrying out of a plan of action must be done within the context of situations that vary by states or other political entities. So long as the basic elements are put together in workable fashion, the final pattern of implementation may vary in a good occupational health program.

ORGANIZATION

State and local occupational health units are normally subdivisions of environmental health bureaus or divisions in departments of health. However, since the scope of occupational health also embraces preventive health maintenance of workers and thus goes beyond environmental aspects, the program can also function in a bureau of preventive health service or as a separate administrative unit of the health department. In some states, the industrial hygiene program may be the total or partial responsibility of a state department of labor.

PERSONNEL

A broadly-based program requires many disciplines including industrial hygienists, engineers, scientists, physicians, nurses, and supporting auxiliary staff.

For an effective minimum environmental program, staff should include at least one administrator, well-trained in industrial hygiene, one full-time field industrial hygienist, one specially trained chemist, and at least one secretary-stenographer. A rule-of-thumb for field industrial hygienists is one per 35,000 workers in areas with heavy industries; and in less industrialized areas, one per 50,000 workers. In clinical services, an occupational health nursing consultant is an essential member of the occupational health team. Her major task is to promote nursing services in industry and better utilization of those services now in existence. A physician, at least on a consultant basis, should be available for assistance with medical problems and in appraising the health of workers.

TRAINING

Trained personnel are at a premium. Established occupational health agencies can employ basically qualified individuals—those having a college degree in engineering, chemistry, physics or biology—and provide them in-service training by its own experienced staff.

Opportunities for other training, however, are relatively good. PHS periodically provides training courses lasting from one to two weeks, for occupational health personnel. State occupational health units likewise sponsor one-or-two-week courses for various disciplines either alone or in cooperation with PHS. Refresher courses on specific aspects of occupational health and environmental health are offered in conjunction with annual meetings by various professional organizations. Some universities also offer similar short courses lasting one to two weeks.

Consideration should be given to the use of technicians and industrial health aides—sub-professionals who under proper supervision can perform many of the routine tasks necessary in environmental control. Recruitment of such personnel could come from qualified junior college or high school graduates in inner city and rural areas.

BUDGET

Budget allocations are provided for salaries of personnel; travel; field and laboratory instruments, for both additions and replacements; allowances for manuals, books and professional journals; and allowances for special consultation services in areas for which the occupational health agency lacks personnel and capabilities.

LEGISLATION

Regardless of what agency has the occupational health program, it must have adequate legislation to implement it. Legislative needs are determined on an individual basis, taking into account existing legislation, and legislative responsibilities of other state agencies concerned with health and safety of workers. Desirable legislation must include enabling authority for making inspections and investigations of occupational health hazards, right of entry, rule-making and promulgating, and enforcement powers.

EVALUATION

If the evaluation of an occupational health program is to be meaningful, it must be closely tied to the objectives of the program. It must indicate the progress — or lack of progress — being made by the program toward the achievement of its objectives. A meaningful evaluation would indicate the appropriateness, adequacy, effectiveness, and efficiency of programs as measured against stated objectives. Thus, an objective may be stated in terms of reduction in dust or other contaminant levels in given work situations. The objective has been met if the levels were in fact reduced. An objective may be stated as reduction in number of days of worker absence or restricted activity. Increase in lighting levels, number of plants previously uninspected, but which now receive visits from the industrial hygienist, and reduction in hazardous or marginally listed workplaces, are also acceptable objectives which can be measured.

In an occupational health program, the Plan of Action may include certain activities such as inspections, in-plant health services, or statistical reports of data. Some of these kinds of activities may be means for attaining the defined objective; others may relate to the program's objective in an evaluation or reportorial way. Obviously, there is a need for continuing vigilance to insure that such activities be carried out; in other words, there also needs to be evaluation of the means and tools being used to achieve objectives. Such evaluation, however, should not be confused with that of reduction of illness, prevention of disease or decrease in pollution—which measure overall program effectiveness.

RECREATION

INTRODUCTION

The conservation, development, and wise use of outdoor recreational resources are of great importance in satisfying the health and well-being goals of our population. Expanding leisure time, growing interest in outdoor recreation, increased urbanization and mobility of people, and a rising standard of living make it possible for more people to seek and utilize recreation areas. Planning for recreational health should be concerned with increasing the number of accessible recreational units as well as maintaining present facilities. Recreation planning must recognize the need for urban facilities, such as neighborhood playlots, playgrounds, open space for rest, ornamental and walkway parks and greenbelts in addition to remote area facilities. An active environmental program covering all recreation areas can insure that these visitors not be exposed unnecessarily to disease or safety hazards. If properly conducted, this objective can be accomplished without destroying or interfering with the challenge and enjoyment the visitor receives. "Recreation area," refers to land and water areas dedicated to the enjoyment of the public. Such areas generally involve facilities operated by a public agency, concessions, voluntary or private groups, or individuals and include playgrounds, parks, campgrounds, shelters, picnic areas, recreation vehicle parking areas, resorts, motels, hotels, cabin camps, organization camps, marinas, and other facilities relating to hiking, picnicking, camping, touring and sightseeing. The U. S. has approximately 65,219 public recreation areas covering about 491,297,919 acres. In 1968, an estimated 4.4 billion visits were made to these areas.

From the environmental health standpoint, planning of recreation areas and the provision and maintenance of facilities have not, in many instances, kept pace with the rapidly increasing visitor loads. Lack of consideration for safety during planning results in visitors being exposed to hazards leading to possible injuries or death. Where facilities such as water supply, sewage disposal, and solid wastes handling are inadequate or totally lacking, the visitors will fend for themselves. This creates conditions which are grossly insanitary and cause serious environmental problems.

Estimates are that adequate sanitation facilities and health-related safeguards should approximate one-third of development costs for new recreation areas. Demands for outdoor recreation within the next 40 years are expected to at least triple. Emphasis should be placed on the need for cooperative participation of all levels of government, private enterprise, and citizens for the planning, provision and maintenance of the recreation environment.

Most state health departments do not have adequate programs for improving environmental conditions in recreational areas. The typical state activity in this field varies widely. A few of the larger state health departments have specific people in environmental health to work only on recreation-area activities. In these states, the health department has influenced the proper design and operation of recreational areas. In other states, however, where the health departments are less active due to fewer personnel, the tendency is to deal with the environmental aspects of recreation areas only if they become a specific problem. In such cases routine surveillance is minimal and cooperative channels between the health and recreation agencies may be limited or non-existent. Responsibility for routine surveillance is oftentimes allocated to local health departments.

A possible solution to the surveillance manpower shortage is to utilize personnel from the recreation agency and consumer groups such as conservation organizations, recreation associations, etc., with some environmental health training. A simple recognition

Preceding page blank

of the possible hazards will many times encourage recreation personnel to request health department assistance in planning new facilities or operating existing facilities which are potential problem areas.

HEALTH PROBLEMS PECULIAR TO RECREATION AREAS

There are unusual conditions of location and use encountered in many recreation areas which often make it difficult to apply the same public health protection solutions or procedures that have been found satisfactory in the average city or community. These conditions include:

1. *Seasonal Operation.* Operation of recreation areas such as camp or lake resorts on a seasonal basis create special health problems. Adequate public health precautions require use of devices and equipment such as chlorinators which may not operate well or be easily maintained under adverse weather conditions and intermittent use. Biological waste treatment processes are quickly upset by extreme temperature variations and intermittent use. Seasonal operation also creates problems related to personnel and staffing. Since there are many recreation areas which must be surveyed during a relatively short season, it may be necessary for a health department to take on additional staff or divert existing staff personnel from other activities. An additional complication is the fact that recommendations made one season may not be correctable until the next.
2. *Public Behavior.* A serious difficulty in many recreation areas is irresponsibility of some visitors. Careless disposal of garbage is a major contributing factor to fly production and nuisance in recreation areas. Potential vandalism must be a consideration in the design of sanitation facilities.
3. *Vector and Animal Problems.* Recreation in the outdoors provides the recreationist with increased exposure to rodents, animals, reptiles, insects and other animals, which may pose a threat to health and safety.
4. *Noxious Plants and Weeds.* Contact with these are increasing as greater numbers of people are exposed to the outdoor environment. Millions of Americans suffer from hay fever and dermatitis from poison ivy, oak and sumac. Noxious plant control is required to provide relief in areas of serious infestation.
5. *Remote Locations.* Lack of electric power and roads in remote areas causes many problems in design, construction, and operation of sanitation facilities. It also means that it is more difficult to provide proper environmental health surveillance of these facilities.
6. *Landscape and Wildlife Protection.* The objectives of many recreational activities require, among other things, preservation and development of the natural scene for enjoyment by present and future generations. This factor of landscape protection requires many innovations and often results in the use of alternative methods which must be evaluated to be certain that basic public health practices have been followed.
7. *Inadequate Design and Criteria.* Adequate studies have not been conducted to produce dependable design criteria on such things as the per capita water requirements for different recreation settings or the quantity of sewage or the amount of solid waste to be expected. Criteria presently being used has been extrapolated from similar community-type situations.

Although environmental conditions of some of the recreation areas in a state indicate that there are potential health problems, it is sometimes difficult to link these conditions with cases of disease or injuries in order to point their health significance and the need for a total environmental health program. The fact that families visit several recreation areas during their vacation and that symtoms of disease do not appear until after they return home, points out the difficulty in tracing cases back to any one environmental condition. It is, therefore, difficult for a state to evaluate, identify, and quantify environmental health problems which result from the condition of recreation areas under its jurisdiction. The health department may first of all look at national trends to see where problems are becoming apparent in other parts of the country. For example, statistics indicate that drownings occuring from boat accidents are a major problem. A number of outbreaks of infectious disease have occurred in organized recreational summer camps. If there are many camps located within a state, this may be the best point at which to begin a concentrated program. The state health department will also want to study vital statistics to see if there are any trends in diseases or injuries which can be directly traced back to the recreation environment. Other sources of information include state recreation vehicle organizations, state and local camping and sportsmen's associations, physicians in the area surrounding large recreational facilities and insurance companies who cover recreational facilities and persons attending them. With these statistics and indications of probable problems as background, a representative survey should then be conducted of several of the recreation areas to determine exactly what environmental conditions do exist. There are no strict standards for a survey of this type, but information on recreation area surveillance forms which are used by other states is available from PHS.

OBJECTIVES

The overall goal of recreational health is to improve environmental conditions in all recreation areas—reduce cases of disease, injuries, and deaths associated with recreation. A time period of 3 to 5 years might be chosen for the achievement of more specific objectives. Some typical objectives are:

1. Eliminate all unsafe drinking water supplies in recreation areas within two years.
2. Reduce by X% the number of cases of food-borne illness traceable to food services in recreation areas during next season.
3. Eliminate all unapproved sewage disposal facilities in recreation areas by 19.....
4. Reduce by X% the number of drownings occurring in recreation areas within X (number) of years.
5. Reduce by X% the number of traffic injuries and by Y% the number of traffic deaths occurring within recreation areas by 19.....
6. Develop a master plan and obtain recreational facilities in urban areas to serve an additional X% of the population within X (number) of years.

PLAN OF ACTION

Many important considerations must be included in the overall planning, development, and operation of recreation areas to insure that proper health protection of individuals visiting or residing in or near such areas will be provided and maintained.

DEVELOPMENT OF CRITERIA AND STANDARDS

The first element is to evaluate the responsibility of the health department and the legislative authority under which a program can be carried out. The broad legislative mandate given to a state to "protect the public health" usually covers this. Specific regulations and minimum standards covering recreational areas should then be developed. Many of the regulations may already exist, i.e., water supply, food service, and waste disposal. Some states may prefer to develop additional standards to cover specific types of recreation areas or facilities such as "camp" standards and "swimming pool" standards.

PLAN REVIEW

A regulation should be developed which will require submission of all recreational area plans to the health department. Master plans should also be included in order that the original site selection may have the benefit of this review. If the plans are to be reviewed by more than one person or department, the channel of flow of the plans should be predetermined. A maximum time limit for review should be an established process so as not to impede progress in recreational area development.

ENVIRONMENTAL HEALTH SURVEYS

To evaluate existing facilities and to enforce minimum health standards in all recreation areas it is necessary to make periodic surveys. The frequency of these surveys depends upon the type of recreation area, type of facilities, cooperation and competency of recreation area management and health department manpower. Since recreation areas include facilities involving many phases of environmental health, sanitarians are probably best equipped to conduct surveys. Design review should be handled by sanitary engineers. The survey should include: site selection, watershed management, water supply, liquid and solid waste handling and disposal, housing, plumbing, food services, campgrounds and picnic areas, marinas and boating facilities, pools and natural bathing places, fish cleaning facilities, vector control, safety hazards, and recreation vehicle parking areas.

LABORATORY ANALYSIS

Laboratory analysis of water, sewage, and vector samples will be needed to provide adequate analysis and continuing surveillance.

TRAINING

Training is planned to acquaint recreation area management personnel with the minimum required standards and the possible potential public health hazards. Training courses on proper operation of water supply, sewage disposal and solid waste disposal facilities should be offered to recreation area maintenance personnel and food service training should be offered to all food personnel. This training should be conducted by state or local personnel. Some training may require formal courses and some will be given on an individual basis. Assistance in conducting this training may be obtained from PHS.

COOPERATION WITH OTHER AGENCIES AND ACTIVITIES

It is extremely important that the health department cooperate as closely as possible with all other agencies. For instance, if water pollution abatement is not a health department function, or if water resources are controlled by another agency, it is important that cooperation and coordination be developed in that area. If federal agencies such as the Corps of Engineers or Soil Conservation Service are operating within the state, channels of communication and cooperation must be opened and maintained. Some cooperative agreements will be developed on a formal basis for reimbursement purposes but others will be completely informal. The health department may also benefit through cooperation with private recreation associations and groups.

ORGANIZATION AND MANPOWER

In a large health department, it is possible to establish a branch of environmental health to be responsible for recreation areas. In smaller departments, a portion of several sanitarians, engineers and injury control specialists' time will be allotted to recreation activities. A coordinator should have access to all other specialists and services offered by the health department. The most critical manpower problem will most likely occur in attempting to conduct baseline surveys to determine the extent of environmental health problems in existing recreation areas. To accomplish this, two alternatives should be considered.

Plan 1

Initiate a program where all available environmental health personnel are used for a short period to conduct the preliminary surveys of the recreation areas and gather the necessary baseline information.

Plan 2

Decide which recreation areas, facilities and types of activities could present the most potentially hazardous environmental health problems and then concentrate on these with the limited manpower available. Consideration in determining these priorities will include:

1. Type of area (rural, urban, resident camp).

2. Type of facility (food service, water supply, waste disposal).
3. Type of activities (swimming, camping, organized games).
4. Number of persons using area.

CONSTRAINTS

One constraint is the lack of recognition of the existing and potential public health problem. Another constraint is the lack of financial support for the program.

IMPLEMENTATION

Some of the preliminary activities necessary for program implementation include:

1. Establish working relationship with agencies, organizations, and groups involved in recreational activities.
2. Develop list of all existing and proposed recreation areas.
3. Evaluate existing legislation and develop needed legislation and regulations.
4. Conduct environmental health surveys of existing recreation areas to obtain baseline information and to pinpoint potentially hazardous conditions.
5. Implement procedures to require submission of plans for all proposed sanitary facilities.
6. Begin review of all construction drawings and plans for development of facilities having sanitary and/or safety significance.
7. Hold conferences with recreation agencies concerning the results of the baseline survey and suggest plans and a timetable for elimination of the hazards.
8. Publish and distribute regulations and minimum standards being used for evaluation of the recreation areas.
9. After regulations have been firmly established, begin enforcement.
10. Begin periodic surveys.
11. Develop training courses for recreational area management, maintenance and concessionaire personnel.

EVALUATION

The progress made in upgrading the environmental health of recreation areas generally is difficult to measure by reduction in number of cases of diseases. By the time disease symptoms occur, the recreationist may be many miles away and is not sure of the point of disease exposure, and is not interested in making any attempt to find out. Therefore, the health department responsible in the recreational area is seldom notified. Other parameters can be used which will give an indication of program progress. It is necessary to first establish accurate baseline information from which future progress or regression can be measured. Available information on injury rates and health problems should be gathered from the park or camp administrators and physicians in the area.

Environmental health surveys of each park, camp or other recreation areas will establish baseline information on the existence and condition of necessary sanitary facilities such as the numbers of unapproved water supplies, unacceptable waste treatment systems, inadequate solid waste disposal sites or the level of sanitation in the food service operations. The following year's progress may then be evaluated on the baseline information established. Suggested measures for progress may include, but are not limited to the following:

1. Number of unsafe water samples received from recreation area supplies.
2. Number of water supplies gaining approved status.
3. Number of waste disposal systems upgraded to approved status.
4. Number of recommendations made to park or camp administrators which were accepted and carried out.
5. Reduction in demerit points given on food service inspection.
6. Number of hazardous environmental conditions eliminated.
7. Total cost of improvements made to sanitary facilities in the recreation areas.
8. Reduction of the incidences of environment-associated diseases.

Evaluation using these parameters points out where increased emphasis is needed during the coming year. Three to five years after a concentrated program has begun, it may then be possible to measure progress in terms of the original established objectives—reduction in cases of disease and number of accidental injuries and deaths.

FOOD

INTRODUCTION

A basic need of man is safe, wholesome, nutritious food. However, food can be a source of disease agents, toxins, poisons, and malnutrition. Authorities estimate that two to ten million people in this country contract some form of food-borne disease annually. The economic loss as a result of this, in terms of drain on our personal health care resources and loss in productive effort, amounts to billions of dollars each year. Development of new foods and widespread use of new technology in the food industry contribute to a proliferation of products whose health impact is relatively unknown. Filthy or decomposed raw materials or existence of insanitary conditions in food manufacture and processing plants are conditions no longer acceptable to the consumer.

Rapidly advancing nutritional knowledge has brought about improvement in the quality of our diet, leading to a remarkable decrease of nutritional deficiency diseases. For example, pellagra, which once claimed more than 7,000 lives yearly, is now so rare that it is not even catalogued in the current National Nutritional Survey. Improvement must be maintained and extended by ensuring that nutrients are not destroyed by preparation, processing, storage, or product deterioration. Manufacturers who introduce new foods or new food processing techniques should be provided guidelines for nutritional quality which must be provided by each such food.

Food protection has become sufficiently complex to defy complete control at any one level of government. Sanitation problems can occur in any of 45,000 food processing establishments, or among 25,000 manufacturers, warehouses, and other types of firms. In addition, there are approximately 500,000 food service establishments in the United States in which contamination may occur. There is a need to develop, conduct, coordinate and strengthen programs to provide more comprehensive protection throughout the food chain from production through consumption. Environmental health agencies have a responsibility to see that this protection is provided, either directly or through other competent agencies.

MISSION

The primary elements which comprise the mission of food protection are:

1. To assure wholesome and clean food free from unsafe bacterial and chemical contamination, filth, and natural or added deleterious substances.
2. To assure adequate nutrition by ensuring compliance of foods with established nutritional quality guidelines, and with standards of quality and identity, and by ensuring that foods marketed for special purposes are suitably labeled to fully inform as to their nutritional attributes.
3. To prevent food-borne disease transmission and prevent significant microbiological and chemical contamination and decomposition during production, processing, distribution, storage, preparation, and service.

CURRENT STATUS OF PROGRAMS

Federal Activities

The Food and Drug Administration (FDA), Public Health Service, U.S. Department of Health, Education, and Welfare is the principal federal food regulatory agency and its responsibilities cover all food commodities except meats and poultry, which are regulated by the U.S. Department of Agriculture (USDA). FDA's major program activity is directed to supervision of food processors and distributors engaged in interstate commerce and it cooperates with states in shellfish sanitation, the Grade A milk program, and food service sanitation. Consultative and technical assistance is provided to states along with recommended ordinances, codes, and standards on food products. Meat and poultry inspection laws as administered by

USDA prohibit interstate movement of uninspected meat and poultry. The program consists of mandatory examination of food animals and their carcasses at the time of slaughter, and inspection at all stages of the preparation of products derived therefrom. The laws provide for destruction of condemned products to prevent their use for human food. All ingredients used in meat and poultry food products are examined for fitness and labeling. Standards of identity are provided for. The laws also cover the importation of meats, poultry and related products.

State Activities

All states have some form of food protection program. Many state and local programs are more effective than federal programs in providing protection to the consumer. These programs vary from well organized effective ones such as the Grade A, Interstate Milk Shipper Program to no program activity in some areas. By 1970, 37 states had enacted food laws essentially uniform with the food provisions of the Federal Food, Drug and Cosmetic Act. The responsibilities at the state and local level are distributed among a variety of agencies and patterns of responsibility vary from state to state. Twenty-eight states require mandatory enrichment, whereas federal regulations provide for optional enrichment of basic cereal grain foods. State actions, in this case, have influenced the extent of enrichment on a national basis.

In many states there is considerable program activity at the county or city level which may be conducted as an extension of the states program or may be conducted under local regulations. In these states, local government agencies have primary responsibility for food service and milk sanitation. City and county health agencies have established permit requirements and public health standards for retail food and beverage establishments, dairies, and related food establishments as part of their total environmental health program. Such activities normally constitute a significant portion of the money and manpower expended by local agencies on environmental health problems.

Many national trade and professional associations promote quality control and sanitation guidelines for industry. On a voluntary basis, these programs vary from purely advisory to industry supported inspectional and analytical programs. In addition, private firms specialize in providing technical consultation to industry.

PROBLEMS

The following are the primary problems of concern to state and local food regulatory agencies:

1. *Microbiological Contamination.* It is estimated that up to ten million Americans suffer from food-borne illness annually. Salmonellosis, shigellosis, illness due to *Clostridium perfringens, Vibrio* and viruses, and food poisonings caused by *Staphylococcus* and *Clostridium botulinus* toxins are transmitted through contaminated foods. Development of new foods, changing distribution and delivery systems, centralizations of food processing, and widespread use of new technologies and procedures result in increased potential for food-borne illness. Problems of food sanitation are complicated by the use of filthy or decomposed raw materials or by insanitary conditions in food manufacture, processing, and delivery systems which permit finished product contamination. This contamination often has detrimental health implications. Thus, sanitation is an integral part of all other food programs.

2. *Chemical Additives Contamination.* The average American is said to consume three pounds of chemical additives in his food each year. Food protection demands assurance that the additive performs its intended use, and that maximum level of each additive introduced into the total food does not exceed established tolerance. Only approved additives are to be used. Ingestion of naturally occurring toxins such as aflatoxin, fish and shellfish toxins, and plant poisons, is a significant problem. Certain essential nutrients may be used in excessive and potentially toxic

amounts because of ignorance, individual taste or well-meaning zeal. These include salt, various amino acids for flavor or technological use, vitamins and mineral essentials. (For discussion of pesticides in food refer to chapter on "Pesticides.")

3. *Nutritional Adequacy and Availability.* "Nutritional quackery," (deceptive and misleading claims) is a major problem and costs American consumers as much as $500 million a year. This figure does not include slack fill, substitution of cheaper ingredients, or low drained weights which represent economic frauds. Adequate food standards protect the health as well as the pocketbook of consumers, who otherwise might fail to obtain expected nutrients. If the diet is marginal or submarginal, this could have serious health implications.

Another problem is protection of nutrients from loss due to improper storage, excessive shelf life, rancidity, or new processes. Close cooperation is needed with state agricultural and extension services as well as food science and food technology and home economics departments in universities and colleges. Individuals responsible for food preparation and handling in public eating establishments must be made aware of the importance of protecting foods from nutritional deterioration through poor handling during preparation. This problem has not yet been adequately explained to the food industry and food handling detrimental to preservation of nutritional quality is still common in food service establishments.

OBJECTIVES

The objectives of a food protection program depend on size and nature of food industry, status of current programs, potential health hazards, and public awareness. Objectives should be selected with care and must reflect identifiable needs for complete consumer protection. While specific objectives vary, the long-range objective is to bring the food industry under a comprehensive food protection program which will provide adequate consumer protection at all stages in the manufacture, storage, distribution and service of foods. Each objective should be set in a time frame. Short-range objectives might include:

1. Establish a comprehensive program of inspection and sampling of manufactured food products within one year.
2. Conduct routine inspections of all storage and distribution points to insure proper handling of foods each year.
3. Bring all food service establishments under effective surveillance by 19...
4. Conduct x number of training courses in food sanitation for public health workers, and personnel involved in food production, storage, and service.
5. Establish a system of reporting cases of food-borne illness to determine incidence and identify causative agents by 19.....
6. Implement consumer and industry information programs to focus on current problems and knowledge of control methods by 19.....
7. Implement cooperative food protection programs to eliminate duplication of effort and provide for efficient utilization of available resources within one year.
8. Ascertain the level of industry compliance with established standards and regulations and reduce the incidence of non-compliance by X% through regulatory efforts by 19.....

PLAN OF ACTION

The function of food protection is as varied and complex as the number of categorical programs involved. It is not feasible to propose one uniform plan of action. However, each of these programs contains certain elements which are essential. A program should be designed which will:

1. Establish criteria and guidelines to ensure uniform enforcement at all levels and complete coverage of all firms.
2. Coordinate duplicated responsibilities and identify areas where no responsibility has been assigned.

3. Inspect and/or monitor to determine the level of noncompliance.
4. Delineate principal areas of deficiency and provide guidance for effecting needed improvement.
5. Provide laboratory support.
6. Establish priorities consistent with public protection needs.
7. Establish procedures for program evaluation.

CONSTRAINTS

Constraints most frequently observed concerning food protection programs are:

1. Lack of quantitative data on food-borne illness.
2. Lack of knowledge of long-term effects of many types of food adulteration, contamination, and debasement on health.
3. Lack of public concern reflected in the program receiving low priority among state activities.
4. Competition for funds among state and local agencies.
5. Limited federal financial support for operation of food sanitation programs at the state and local level.

OTHER PROGRAMS THAT RELATE TO FOOD PROTECTION

1. *Communicable Disease.* As food is a vehicle for transmission of disease, epidemiological coordination should be established with the appropriate agency. State health departments have epidemiologists who, among other things, investigate outbreaks of food-borne illness and support local health agencies when problems arise. The Center for Disease Control of the Public Health Service provides federal expertise in food-borne disease epidemiological investigations and studies.
2. *Water.* The quality of water utilized in production and processing of foods has significant impact on food safety, and activities should be closely coordinated with agencies responsible for water quality. Potable water quality is usually a function of the state health department. The federal program is administered by the Public Health Service.
3. *Animal Disease.* Food protection should be coordinated with agricultural agencies responsible for animal disease control and the control of hazards from the use of drugs and other chemicals. Examples of such activities conducted by agriculture are *Salmonella* and mastitis control. The U.S. Department of Agriculture coordinates a nationwide program of animal disease control in cooperation with state departments of agriculture.
4. *Consumer Education.* Food protection agencies should coordinate with the State Agricultural Extension Service and other organizations involved in consumer education.
5. *Solid Waste.* Food wastes must be handled, stored and disposed in accordance with state and local requirements and consistent with the State Solid Waste Plan.

IMPLEMENTATION

The total effort in food protection is fragmented. CHP should play the key role in assuring that all areas of food protection are adequately covered.

PERSONNEL

Well-rounded food protection requires a variety of specialists such as chemists, sanitarians, microbiologists, engineers, veterinarians, dieticians, nutritionists, inspectors, etc. Staff patterns vary from program to program but the number of field personnel should be adequate to meet program objectives.

TRAINING

Due to the need for highly specialized types of personnel to carry out the many facets of a balanced food protection program, a comprehensive training program is needed in the overall plan.

Assistance for in-service training can be obtained from many sources. The two principal federal agencies providing training in food protection are the FDA Training Institute and the Center for Disease Control, both in the Public Health Service. In addition, many state health departments and academic institutions offer general and specialized short-term training courses in the area of food protection.

LEGISLATION

Legislative needs vary in accordance with the particular program to be undertaken. Existing legislation should be reviewed and a determination made as to adequacy of present laws and regulations to meet program objectives. If adequate authority is lacking, new legislation should be considered. Model state legislation and ordinances covering a wide range of food protection activities can be obtained from federal agencies. Some professional organizations also prepare model legislation.

EVALUATION

The ultimate measure of food protection effectiveness is the health of the public. However, mechanisms and systems for accurate measurement of this condition are not always available. For example, incidence of foodborne disease is difficult to measure and to relate directly to the quality of food. Improvement in reporting of incidence of food illness, which could relate directly to a breakdown of sanitary control in the food process chain, would provide a better guide to where greater emphasis is needed. This requires the cooperation of local physicians in reporting incidents and effective epidemiological investigations to determine the causative organisms or chemical contaminant and the point of breakdown in control of the food process chain. A secondary measure of the effectiveness is to evaluate success made toward short-range goals and objectives. This evaluation is a partial indicator of success or lack of success in reaching long-range goals. Food protection should produce and maintain results which are obvious to the community and commensurate with the cost of operation. The program must be evaluated on the basis of accomplishment not activity. Objectives must be based on a realistic, measurable level of public health and food sanitation for a particular time and place. There is a need for frequent review and evaluation of program needs, objectives, and achievements.

Continuing survey and rating activities are built into the program to permit measurement of program effectiveness. It is necessary to develop procedures similar to the following:

1. Procedures for evaluating food service sanitation status.
2. Methods of making sanitation ratings of milksheds.
3. Appraisal methods for rating food manufacture and storage industries.

Any rating activity intended to determine the level of industry compliance must be designed to provide a high degree of uniformity and should accurately reflect changes in compliance with established regulations and standards. The effectiveness of program activities are measured by comparing the level of compliance before and after directed resource expenditures. In applying these procedures, program characteristics are evaluated and program strengths and weaknesses are identified. Another measure of program success might be an infant mortality rate. Infant mortality among lower socio-economic groups is much higher than that of groups enjoying a higher standard of living. Improper nutrition plays an important role in the incidence of infant deaths. Properly utilized, this method of evaluation may prove useful in determining the success of nutritional aspects of protection. Similar procedures can be devised to evaluate other specialized activities of a total food protection program.

DRUGS, THERAPEUTIC DEVICES, AND COSMETICS

INTRODUCTION

Drugs, therapeutic devices, and cosmetics have progressed from such simple items as laxatives, to highly complex substances which profoundly affect all life processes. Significant health hazards result if deviations from the highest standards of compounding, identification, labeling, instructions, cautions and distribution occur. An effective regulatory program protects public health by requiring the proper compounding, packaging, labeling, holding and distribution of these articles and the removal of unsafe products from the markets. The drug industry has available the necessary scientific expertise to market safe and effective drugs. However, expertise in research, managerial decisions, manufacturing practices, quality control, and marketing procedures is not always exercised in a manner that assures a safe and effective product. Some of these products are found to be ineffective or unsafe for their intended purpose, some improperly compounded, and some inaccurately defined as to proper use and hazards. A drug used in treating a food producing animal may create a human health hazard. Residues of the drug in the flesh or other food products must be within acceptable levels. Dangerous therapeutic devices can permanently injure the individual using the device, and reliance on unsuitable devices can prevent or delay a sick individual from seeking proper medical care. While the majority of medical devices on the market are safe and effective, a number of dangerous and worthless devices are sold. The scope of this problem has not been determined.

Manufacturer shipments of shaving preparations, perfumery, hair preparations, dentifrices and other cosmetics totaled about three billion dollars in 1968. Hundreds of new cosmetics, many containing new ingredients, are introduced each year. Health hazards result from unique or repeated exposure to or contact with toxic ingredients. Expanding scientific information and centralized review of injury complaint samples has revealed harmful effects from ingredients, and has disclosed hazards such as bacteria in eye make-up, creams and lotions; formaldehyde in nail hardeners; and high estrogen content in face creams.

MISSION

The mission of total drug, therapeutic device, and cosmetic protection is to assure that all drugs reaching the public have been demonstrated by competent scientific evaluation and testing to be safe and effective for their specified purposes; that they are used only for such purposes; that the health of subjects used in premarketing testing is adequately safeguarded; that cosmetics contain no hazardous ingredients; and that therapeutic devices are safe, effective and appropriate for their intended uses.

FEDERAL ACTIVITIES

The primary federal agency for the control of drugs, therapeutic devices, and cosmetics, is the Food and Drug Administration (FDA), Public Health Service, U.S. Department of Health, Education, and Welfare. FDA has the responsibility for preliminary scientific investigation of new drugs to assure minimum risk to investigational subjects and adequacy of investigational work. A new drug may not be distributed commercially until its safety and efficacy has been scientifically established to the satisfaction of FDA. Veterinary drugs and drugs used for animal feeding purposes are considered in a similar manner. Other FDA activities include, inspection of drug manufacturers, sampling and analysis of drugs, review and evaluation of drug labeling, and determination of industry compliance with established good manufacturing practices. Prescription drug advertising is reviewed for proper information concerning the drug's usefulness and hazards.

In cooperation with states the agency regulates the use of drugs in animal feeds. Ther-

Preceding page blank

apeutic devices are investigated for safety, effectiveness and suitability for use, although pre-clearance of marketing is not now required by law. Cosmetics are examined for potential hazard to health and to assure that only certified colors have been used in their manufacture.

Under the FDA program, voluntary compliance activities range from industry education to suggested specific corrections following inspection. When appeals for voluntary correction are unsuccessful, civil and/or criminal action is employed to accomplish compliance. FDA provides technical assistance and consultation to state agencies administering programs in drug, therapeutic device and cosmetic protection.

The Federal Trade Commission has the legal responsibility for regulating advertising of non-prescription drugs, therapeutic devices and cosmetics. The Division of Biologics Standards, of the Public Health Service, has responsibility similar to FDA with respect to viruses serums, antitoxins and blood products for human use, while United States Department of Agriculture has the same responsibility for such products for veterinary use. The U.S. Post Office investigates and regulates individuals engaged in fraudulent sale of drugs, therapeutic devices and cosmetics through the mails. The Bureau of Narcotics and Dangerous Drugs of the U.S. Department of Justice has the responsibility for controlling the illegal sale, or distribution of narcotics and prescription drugs which have a history of misuse and habit-forming characteristics.

STATE AND LOCAL ACTIVITIES

State departments of health, boards of pharmacies, professional licensing agencies, department of agriculture and other state and local agencies have varying degrees of responsibilities in control of drugs, therapeutic devices and cosmetics depending upon legislative mandates in the individual state. These programs range from very comprehensive to nonexistent. Most state programs are aimed primarily at the wholesale and retail level. Licensing and regulation of retail pharmacies and drug stores is solely a state function. State agencies collect and analyze samples of animal feeds containing drugs, and in cooperation with FDA, inspect manufacturers of medicated feeds. Thirty states have entered into partnership with FDA under the Joint State-Federal Medicated Feed Program. In these states the program directors and food inspectors have been commissioned as officers of the U.S. Department of Health, Education, and Welfare to inspect feed mills under provisions of the Federal Food, Drug and Cosmetic Act.

PROBLEMS

The overall control of drugs, therapeutic devices and cosmetics, most of which move in interstate commerce, is a federal responsibility. The enforcement and regulation of these products must be uniform in all areas of the country. There are, however, many areas in which the activities can be more effectively carried out at the state and local levels. Among such areas are:

1. Intrastate Drugs, Therapeutic Devices, and Cosmetics. New drugs which have been developed and are commercially distributed only intrastate are not subject to federal control as is required for drugs moving in interstate commerce.
2. There are many small drug, therapeutic device and cosmetic manufacturers which limit their distribution to intrastate commerce and are not subject to federal regulations. State requirements for such firms should be equivalent to those imposed upon interstate firms by federal agencies. Drug and device quackery is another field in which state agencies can supplement federal consumer protection activities, since many of these cases involve small firms where interstate commerce is difficult to demonstrate.
3. Medicated Feeds—About 80% of beef cattle and 90% of poultry receive medicated feeds to stimulate growth and prevent or treat animal disease. The use of these drugs must be supervised to prevent carry-over of medicants to human foods. About 2,000 interstate manufac-

turers and 10,000 local feed mills or mixers produce medicated feed, under varying degree of regulatory control. This large number of manufacturers impose an obligation of inspection and analysis beyond the present capability of FDA. Many states have well-developed medicated feed control programs and their assistance effects a more economical and effective coverage than would expansion of the federal program.

OBJECTIVES

Examples of objectives for a state or local drug, therapeutic device and cosmetic protection program might be:

1. Bring all manufacturers of drugs, therapeutic devices, and cosmetics engaged only in intrastate commerce under effective surveillance by 19 . . .
2. Provide for application of regulatory standards for drugs shipped into and all drugs manufactured and distributed solely within the state within . . years. Remove from the market, either through voluntary means or regulatory action, of all cosmetics when any hazard becomes apparent.
4. Establish a program of regulatory inspection of medicated feed mills, in cooperation with FDA, to insure that all medicated feeds are safe and effective within one year.
5. Establish a system for reporting to FDA adverse reactions to drugs, utilizing hospitals, physicians and other organizations by 19. . .
6. Establish a quackery program which provides for regulatory control of unsafe and/or ineffective drugs and therapeutic devices distributed to the public within . . years.

Priorities depend upon the size and nature of the drug, therapeutic device, cosmetic and medicated feed industry. Resources and legal authority have bearing on the establishment of priorities. Primary attention should be given to those areas where federal jurisdiction is lacking or where state action would be more effective.

PLAN OF ACTION

Since the Federal Act has prime responsibility in establishing national standards and regulations, a state or local program should be designed to supplement the federal program in those areas not fully covered by federal authority. Programs should be coordinated with federal and other state agencies to avoid duplication of effort and insure that all areas of responsibility are covered. It is not practicable to design one uniform plan of action suitable for all states because of variation in products involved and the great range in the size of the industry from place to place. Any plan of action should be tailored to the areas of responsibility for regulation of the industry involved and should provide adequate consumer protection.

Effective operation may require any of the following:

1. Designate a lead agency to identify existing agencies and the statutory authority under which they operate.
2. Determine the extent of drug, device, cosmetic and medicated feed industry in the state.
3. Determine if any inadequacies exist in the present legislative pattern and if so, propose legislative corrections.
4. Design a surveillance program based on responsibilities developed as a result of coordination among agencies. Such a program may require inspections, sampling, laboratory analysis, industry education, and training.
5. Determine what laboratory facilities are available and what are needed.
6. Adopt rules and regulations which provide for prompt, orderly removal of hazardous or potentially hazardous drugs, devices, and cosmetics from the channels of commerce.
7. Establish contacts with hospitals, medical associations, and veterinary associations to provide for information exchange on adverse reaction reports, drug recalls, and new products being marketed.
8. Set up a consumer education program designed to alert the public to potential

hazards and to advise on safeguards in the home for safe storage, holding and use of these products.

CONSTRAINTS

Recognized constraints include:

1. Lack of public awareness of the need for these programs at the state or local level.
2. Poor funding resulting in salary schedules which will not attract and retain adequately trained and experienced personnel.

COORDINATION WITH OTHER AGENCIES

These programs impinge upon many state agencies such as boards of pharmacy, health departments, agriculture departments, boards of licensing, state attorney offices, and other organizations. Close coordination among federal, state, local and volunteer agencies is essential, and the CHP agency can function to provide this coordination.

IMPLEMENTATION

ORGANIZATION

All program elements described in the plan of action need not be placed in any single agency. For example, the medicated feed program would most appropriately be placed in the existing feed control agency. The medicated feed inspector's background would not normally qualify him for drug, therapeutic device and cosmetic control activity, nor visa versa. Drug control programs at the state level are located in a variety of state agencies. The efforts of all drug programs should be coordinated for more uniform application.

PERSONNEL

An effective drug inspection program requires personnel trained and experienced in investigation of drug formulation, manufacturing practices, testing and control procedures, quality control procedures, and marketing. In addition, qualified administrative personnel are needed as program managers. The laboratory staff should consist of adequately trained scientists capable of performing the sophisticated analyses required to support this program. The regulation of the device and cosmetic industries requires similar expertise adapted to the industries involved. Such expertise is acquired primarily from experience; however, specialized training is available for particular facets of the program.

LEGISLATION

Adequate legal authority should be established to regulate the industries as part of the implementation of any control program. If existing legistlation is inadequate, model state legislation is available from FDA.

EVALUATION

The basic measure of effectiveness in this area is the status of human health. When this measure cannot be used satisfactorily, secondary items can be selected as indicators. In light of existing overall federal responsibility, evaluation of state and local programs should be conducted in such a manner as will provide a measure of program effectiveness in their area of responsibilities as well as those activities supplementing federal programs. Several agencies may be involved in various components of the program and evaluation may have to be based upon the coordinated efforts of all. This requires a determination of success in achieving governmental program objectives and using this as a measure of individual program effectiveness. The CHP agency is in a unique position to make this determination.

A comprehensive, coordinated, well organized system of records is essential to the conduct of an effective evaluation program. Records must be kept if the regulatory authority is to determine the performance of each establishment and to know when administrative or enforcement action procedures should be initiated. Review of the records reveals the rate of compliance with good manufacturing practices established for drug manufacturers and feed mills. The degree of compliance with good manufacturing practices could be evaluated on inspectional observation and by the number of violative samples and the number of recalls necessitated by poor quality control procedures in manufacturing. Frequency of labeling violations could be another indicator of effectiveness once the existing level of labeling compliance has been determined.

Periodic evaluation should be made to determine if there are any gaps in the total effort. Such an evaluation should reveal that all manufacturers of drugs, therapeutic devices and cosmetics are being regulated under an effective surveillance program.

OTHER PROBLEMS

State and local environmental health agencies have responsibilities for trying to prevent or ameliorate all health hazards arising from man's interaction with his environment. Most of these hazards are distinctly associated with a particular location (home, workplace), an aspect of the environment (water, air, food), or a significant stressor (noise, radiation) and have such significance that they have resulted in a specific program. Many other hazards to man's health, comfort or well-being, however, require intermittent or only minor program effort. Because these programs can, in aggregate, represent a significant expenditure of resources, consideration should be given to them in planning for environmental health.

DISASTER

Disasters occur upon occasion in each of the states but in some states they occur with such frequency and severity as to require major environmental health activities in connection with them. In areas where natural disasters such as floods, hurricanes, tornadoes, earthquakes, forest fires, or mud slides occur with considerable frequency, estimates of resources needed and contingent plans of action are essential. In any event, some emergency plans are always needed for man-made disasters such as fires, explosions, and civil disturbances.

Certain environmental conditions are of immediate concern and require prompt assistance by knowledgeable personnel following disasters:

1. The safety, adequacy, and availability of water for drinking and culinary purposes. There is need for prior emergency planning by water utilities for emergency supplies, treatment and distribution. Environmental health agencies need to provide surveillance of emergency treatment and handling, to ensure the water's safety.
2. The safety, adequacy, and availability of food. Ordinarily, some packaged foodstuffs are available following disasters but may have been subjected to contamination. In some cases, means for preparation must be improvised. Inspection of foodstuffs, supervision of decontamination and salvages of foodstuffs, and surveillance of emergency mass feeding must be provided.
3. The provision of emergency shelter. Emergency shelters and facilities should be selected and developed prior to disasters. This is usually done by Civil Defense or Red Cross agencies. Environmental health personnel should be involved to ensure provisions for cleanliness of the premises and of bedding; for safety of drinking water and food preparation and distribution; and for provisions for bathing and washing.
4. The provision of emergency toilet facilities and sewage disposal. Temporary toilet facilities are often needed following disasters in connection with emergency feeding and shelter facilities. Prior planning is necessary to identify facilities, their utilization and servicing. Surveillance for this service and for adequate disposal of toilet wastes is essential. In addition, emergency treatment or decontamination of sewage from broken sewer lines or damaged treatment plants may be necessary. Sewerage works officials should have prior contingent plans for such emergencies.
5. Provision for emergency disposal of solid wastes and vector control. Dead animals and contaminated or unusable food must be disposed of promptly to avoid proliferation of flies and rats. Provisions are needed for removal and burial or adequate cover. Refuse collection and public works agencies should develop emergency plans for such service. Frequently natural disasters are accompanied by excess rainfall and mosquito control measures must be taken

Preceding page blank

soon after the disaster to avoid an upsurge of mosquito populations. Damaged and destroyed buildings can provide additional shelter and food for rats and special control programs may be needed.

NUISANCE AND COMPLAINTS

Environmental health agencies receive many complaints concerning environmental conditions. These include complaints about annoyances as well as health hazards. Many are specific to an organized, ongoing program (e.g., air pollution) and can be referred to that program for attention. Others have to do with conditions associated with premise cleanliness, odors, roadside dumping, weeds, etc. Since this is a principal point of contact between the agencies and the public they serve, such complaints should be handled promptly. Many complaints are essentially repetitive and result from causes amenable to control. If analyzed, they can assist in the identification of program gaps and lead to special preventive or remedial efforts. They can also serve as indicators of the effectiveness of ongoing programs and represent an opportunity for public education and information.

RABIES CONTROL

In many states, rabies is endemic in the wild mammal population leading to intermittent occurrences in domestic animals and consequent exposure of humans. Although activities for rabies control are often carried out by others, environmental health agencies should assure themselves that such programs include: vaccination of dogs and cats against rabies; licensing of dogs; collection, impoundment and elimination of stray dogs and cats; and investigation and follow-up of animal bites of humans, including quarantine and examination of the animal.

OTHER ANIMAL CONTROL

Because of nuisances arising from flies, odors, noise, and allergies, many communities regulate domestic animals such as pigs, horses, cows, goats, chickens, and pigeons, as to location, number, cleanliness of premises, etc. Such regulations can eliminate the sources of many complaints.

MIGRANT LABOR CAMPS

In most states there are migrant, seasonal laborers. These groups often experience relatively high levels of disease. Providing health, education and other services often requires special effort because of ethnic, language, and economic problems. These problems also compound the assurance of adequate housing and water supply and waste disposal facilities. Several states have developed standards for minimum housing for migrants. California has a food crop sanitation law requiring facilities in the fields. The U.S. Department of Labor has recommended housing standards in connection with the employment services they provide to growers. PHS provides regional consultants in areas where there is a large migrant labor population. Inventory, regulation, and surveillance activities should be carried out by environmental health agencies for migrant labor camps where a problem exists. Educational programs for migrant laborers in the use and maintenance of facilities and prevention of disease and injury are essential.

FAIRS, CARNIVALS, ATHLETIC EVENTS AND OUTDOOR MEETINGS

These events present special environmental health problems because they involve large crowds over short periods of time using mobile, temporary or even improvised facilities. Prior planning and working out of environmental measures should be required for all such gatherings. Water supply, food and beverage service, and waste disposal all constitute potential hazards. Special problems of fly, mosquito, and rodent control may be encountered. Entertainment rides and temporary electrical service may present safety hazards.

SEPTIC TANKS

Septic tanks represent an effort to provide modern, water-carried sewage disposal on an individual basis where community sewage systems are not available. They have been widely used in developing suburban areas as an intermediate provision until the density of the development justifies or permits community sewers and treatment plants. Because they frequently fail due to adverse soil conditions, with surfacing of partly treated sewage, severe health hazards often result. Environmental health agencies usually allow installation only by permit, where soil, drainage and space conditions are adequate and in accordance with standards such as set forth in PHS Bulletin #526. Even under the most favorable conditions, some degree of failure will be experienced. Consequently, planning should be incorporated for trunk sewer lines or other facilities in anticipation of such need. Subdivision regulations should generally prohibit septic tanks. The U.S. Department of Agriculture has excellent information on local surface soil types and conditions. PHS has a suggested model planning law for water and sewage disposal facilities.

PLUMBING

Because plumbing is used to convey and dispense drinking water and collect and convey sewage, a number of health hazards may be associated with plumbing, especially where there is direct or indirect connection between the drinking water and waste water or sewage. Consequently, a number of states and communities require licensing of plumbers and a permit for plumbing installation. These programs may be administered by building or public work agencies or by environmental health agencies to be sure that the pertinent regulations and inspections include adequate provisions for safeguarding the water supply against back-siphonage and contamination and assuring that the waste lines do not leak or back up. Standard codes are available providing for such safeguards, such as the National Plumbing Code and the Uniform Plumbing Code.

ICE MANUFACTURING AND BOTTLED WATER SUPPLIES

These establishments come under the surveillance comparable to that of agencies concerned with food protection. PHS has recommended standards for ice manufacturers.

BEAUTY AND BARBER SHOPS

Because of the possibility of skin or hair infections, such establishments are usually licensed and must operate under standards specifying cleanliness and means of disinfecting utensils used for more than one person.

LAUNDRIES AND SELF-SERVICE DRY CLEANING SHOPS

Some hazards are associated with possible transmission of infections in diaper laundries and public laundries, particularly self-service laundries using home style machines with only moderately hot water. Self-service dry cleaning shops have a potentially significant problem of exposure to fumes from the dry cleaning fluid. Most states and some communities license and inspect all such establishments. The National Dry Cleaning Association has recommended standards.

MISCELLANEOUS

A number of other public and semi-public establishments or facilities may represent environmental health hazards to a portion of the population. These include such places as public rest rooms, highway rest stops, mobile construction toilets, train depots, bus stations, vessel terminals, and airports.

BIBLIOGRAPHY

PLANNING

Anderson, Richard T., *Comprehensive Planning for Environmental Health,* Division of Urban Studies, Cornell University, Ithaca, New York, 1964

Deniston, O. L., I. M. Rosenstock and V. A. Getting, *Evaluation of Program Effectiveness,* Public Health Reports, April 1968, Vol. 83, p. 323

Environmental Health Planning, The University of Michigan School of Public Health, Ann Arbor, Michigan, 1965

Environmental Health Planning Guide, U.S. Department of Health, Education, and Welfare, Public Health Service Publication No. 823, GPO, Washington, D.C., 1968

Environmental Quality; The First Annual Report of the Council on Environmental Quality, Transmitted to Congress, August 1970, Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

Goodman, William I., and Friend, Eric C., *Principles and Practice of Urban Planning,* Washington: International City Managers' Association, 1968

Logan, John A., Opperman, Paul, and Tucker, Norman, *Environmental Engineering and Metropolitan Planning,* Northwestern University Press, 1962

Mandelker, Daniel R., *Managing Our Urban Environment,* Indianapolis: Bobbs-Merrill Co., 1966

Problems of Zoning and Land-Use Regulation, The National Commission on Urban Problems, Research Report No. 2, Washington, D.C.

AIR

A Compilation of Air Pollutant Emission Factors for Combustion Processes, Gasoline Evaporation, and Selected Industrial Processes, Public Health Service Publication No. 999-AP-42, May 1965

A Compilation of Selected Air Pollution Emission Control Regulations and Ordinances, Public Health Service Publication No. 999-AP-43, Revised Edition, 1968

Air Pollution Control Field Operations Manual, Public Health Service Publication No. 937, 1962

Community Action Program for Air Pollution Control, National Association of Counties Research Foundation, Washington, D.C. A packet of guide booklets published 1966

Executive Order 11282, May 26, 1966; Control of Air Pollution Originating from Federal Installations. (Additional executive orders are available from the National Air Pollution Control Administration, HEW.)

Free Films on Air Pollution, Public Health Service Publication No. 1264, Revised October 1969.

Guide to the Appraisal and Control of Air Pollution, American Public Health Association, Inc., New York, New York; second edition, 1969

Guidelines for the Development of Air Quality Standards and Implementation Plans, National Air Pollution Control Administration publication, DHEW, May 1969

Manual for the Development of State Recommendations for Air Quality Control Regions, National Air Pollution Control Administration publication, DHEW, January 1970

Progress in the Prevention and Control of Air Pollution; Reports of the Secretary of Health, Education, and Welfare to the Congress of the United States, a series of annual reports beginning May 1968

Progress in State and Local Air Pollution Control Under the Clean Air Act, Charles D. Yaffe, presented at the American Industrial Hygiene Conference, Denver, Colorado, May 14, 1969

Rapid Survey Technique for Estimating Community Air Pollution Emissions, Public Health Service Publication No. 999-AP-29, October 1966

Preceding page blank

State Air Pollution Control Act, Suggested State Legislation—Volume XXVI—1967; Council of State Governments, Lexington, Kentucky

The Clean Air Act, as amended; P.L. 90-148, 42 U.S.C. 1857-18571, and standards and regulations published in the Federal Register persuant thereto

The Cost of Clean Air; Reports of the Secretary of Health, Education, and Welfare to the Congress of the United States, a series of annual reports beginning June 1969

WATER

Community Water Supply Study, DHEW-PHS, Environmental Health Service, 1970

Gastroenteritis Epidemic, Journal of American Water Works Association, Vol. 58, No. 11, November 1966

Greenburg, Ongarth, Browning, and Mankin, *Salmonellosis in Riverside,* Journal of American Water Works Association, Vol. 58, No. 9, September 1966

Inventory of Municipal Water Facilities 1963, PHS Publication No. 775, Superintendent of Documents, GPO, Washington, D.C.

Manual for Evaluating Public Drinking Water Supplies; A Manual of Practice Recommended by the Public Health Service, PHS Publication No. 1820, GPO, Washington, D.C.

The Nation's Water Resources—A Summary Report, U.S. Water Resources Council, Washington, D.C. 1968

Public Health Service Drinking Water Standards 1962., PHS Publication No. 956, Superintendent of Documents, Government Printing Office, Washington, D.C.

Standard Methods for the Examination of Water and Wastewater, American Public Health Association, New York, New York

Weibel, S. R., F. R. Dixon, R. B. Weidner, and L. J. McCabe, *Waterborne-Disease Outbreaks,* 1946–60, Journal of American Water Works Association, Vol. *56,* 947–958, August 1964

SOLID WASTES

Black, R. J., A. J. Muhich, A. J. Klee, H. L. Hickman, Jr., and R. D. Vaughan. *The National Solid Wastes Survey; an Interim Report.* Cincinnati, U.S. Department of Health, Education, and Welfare, 1968 53 p.

Committee on Refuse Disposal, American Public Works Association. *Municipal Refuse Disposal.* 2d ed. Chicago: Public Administration Service, 1966. 528 p.

Committee on Solid Wastes, American Public Works Association. *Refuse Collection Practice.* 3d ed. Chicago: Public Administration Service, 1966, 525 p.

Consumer Protection and Environmental Health Service, Office of Program Development. *Issue Study On Solid Wastes.* Washington, U.S. Department of Health, Education, and Welfare, Aug. 1969. 210 p.

DeMarco, J., D. J. Keller, J. L. Newton, and J. Leckman. *Incinerator Guidelines*—1969. Public Health Service Publication No. 2012. Washington, U.S. Government Printing Office, 1969. 98 p.

Gutkind, E. A. *The Twilight Of Cities.* New York, Free Press of Glencoe, Inc. (Div. of MacMillan), 1962. 201 p.

Hickman, H. L., Jr. *Characteristics of Municipal Solid Wastes. Scrap Age,* 26(2): 305–307, Feb. 1969.

Muhich, A. J., A. J. Klee, and P. W. Britton. *Preliminary Data Analysis; 1968 National Survey Of Community Solid Waste Practices.* Public Health Service Publication No. 1867. Washington, U.S. Government Printing Office, 1968. 483 p.

National Academy of Engineering—National Academy of Sciences. *Policies For Solid Waste Management.* Public Health Service Publication No. 2018. Washington, U.S. Government Printing Office, 1970. 64 p.

National Association of Counties Research Foundation. *Guidelines for Local Governments On Solid Waste Management.* Public Health Service Publication No. 2084. Washington, U.S. Government Printing Office, 1970. (In Press.)

National Solid Wastes Management Association and Bureau of Solid Waste Management. *Sanitary Landfill Operation Agreement And Recommended Standards For Sanitary Landfill Design And Construction.* Cincinnati, U.S. Department of

Health, Education, and Welfare, 1969. 44 p.

Office of Science and Technology, Executive Office of the President. *Solid Waste Management; A Comprehensive Assessment of Solid Waste Problems, Practices, And Needs.* Washington, U.S. Government Printing Office, 1969. 111 p.

Proceedings of Symposium on Human Ecology, Airlie House, Warrenton, Va., November 24-27, 1968. Public Health Service Publication No. 1929, Washington, U.S. Government Printing Office, 1969, 123 p.

Restoring The Quality Of Our Environment; Report Of The Environmental Pollution Panel, President's Science Advisory Committee. Washington, U.S. Government Printing Office, 1965. 317 p.

The Solid Waste Disposal Act; Title II of Public Law 89-272, 89th Cong. S.306, October 20, 1965. Washington, U.S. Government Printing Office, 1966. 5 p.

Sorg, T. J., and H. L. Hickman, Jr. *Sanitary Landfill Facts.* Public Health Service Publication No. 1792, 2d ed. Washington, U.S. Government Printing Office, 1970. 36 p.

Toftner, R. O. *Developing A State Solid Waste Management Plan.* Public Health Service Publication No. 2031. Washington, U.S. Government Printing Office, 1970. 50 p.

RADIATION

A Guide for Environmental Surveillance around Nuclear Facilities NF-67-8, December 1967, NCRH, Public Health Service, Department of Health, Education, and Welfare, Rockville, Maryland 20852

A Study of Selected Aspects of State Control of Radiation Hazards, September 1969, Appendix D, Report to Congress on Studies Conducted Pursuant to Section 357 of the Radiation Control for Health and Safety Act of 1968, Public Law 90-602, January 1, 1970, U.S. Department of Health, Education, and Welfare, Rockville, Maryland.

Bulletin of Courses, July 1970–December 1971, Environmental Control Administration, Environmental Health Service, Public Health Service, Department of Health, Education, and Welfare, Rockville, Maryland

Directory of Personnel Responsible for Radiological Health Programs, July 1970, BRH/ORO 70-3, Bureau of Radiological Health, Environmental Health Service, Public Health Service, Department of Health, Education and Welfare (revised every six months)

Ionizing Radiation, American Public Health Association, 1790 Broadway, New York, New York 10019, 1966

Part 1, Summary Report to the Congress on Studies Conducted Pursuant to Section 357 of the Radiation Control for Health and Safety Act of 1968, Public Law 90-602, January 1, 1970 (revised July 1, 1970), U.S. Department of Health, Education, and Welfare, Rockville, Md.

The Atomic Energy Act of 1954, Public Law 86-373 (73 Stat. 688).

Radiation Control for Health and Safety Act of 1968, Public Law 90-602, 90th Congress, H. R. 10790, October 18, 1968

Radiological Health Program Guide by Southern Interstate Nuclear Board, April 1966, Public Health Service, Department of Health, Education, and Welfare.

Report of State and Local Radiological Health Programs. Fiscal Year 1968, July 1969, Bureau of Radiological Health, Environmental Control Administration, Environmental Health Service, Public Health Service, Department of Health, Education, and Welfare. (Fiscal year 1969 in preparation.)

State Radiation Control Act, Suggested State Legislation, Program for 1961, The Council of State Governments, Iron Work Pike, Lexington, Kentucky 40505

Suggested Legislation, Electronic Products Radiation Control Act or Suggested Amendment to Model Radiation Control Act, Bureau of Radiological Health, Environmental Health Service, Public Health Service, Department of Health, Education, and Welfare. (In preparation.)

Suggested State Regulations for Control of Radiation, The Council of State Governments. As amended in 1966. Iron Work Pike, Lexington, Kentucky 40505. (1970 revision is available.)

NOISE

Donley, Ray. *Community Noise Regulation,* Sound and Vibration, February, 1969, p. 13.

Cohen, Alexander. *Issue and Planning Study on Noise Control,* Department of Health, Education, and Welfare, Environmental Health Service, Rockville, Maryland, 1969

Cohen, Alexander. *Industrial Noise, A Guide to Its Evaluation and Control,* Department of Health, Education, and Welfare, Rockville, Md., PHS Publication No. 1572

The Legal Aspects of Noise Control, A compilation of State and Local Noise Codes, Congressional Record, October 29, 1969, pp E9031–E9112

Noise—Sound Without Value, Committee on Environmental Quality of the Federal Council for Science & Technology, 1968

Safety and Health Standards (Including Occupational Noise) for the Walsh-Healey Public Contracts Act, Department of Labor, Federal Register, Volume 34, No. 96, Part II, May 20, 1969

Ward, W. Dixon and Fricke, James E., *Proceedings of the Conference on Noise as a Public Health Hazard,* American Speech and Hearing Association, Washington, D.C. 1968

VECTORS

Bjornson, B. F., H. D. Pratt, and K. S. Littig, *Control of Domestic Rats and Mice,* U.S. Department of Health, Education, and Welfare, Rockville, Maryland, 1969, PHS Publication 563, 41 pp.

Littig, K. S., B. F. Bjornson, H. D. Pratt, and C. F. Fehn, *Urban Rat Surveys.* U.S. Department of Health, Education, and Welfare, Rockville, Maryland, 1969. 14 pp.

Pratt, H. D. and K. S. Littig, *Mosquitoes of Public Health Importance and Their Control,* U.S. Department of Health, Education, and Welfare, Rockville, Maryland, 1969

Pratt, H. D. and K. S. Littig, *Ticks of Public Health Importance and Their Control,* U.S. Department of Health, Education, and Welfare, Rockville, Maryland, 1967. 42 pp.

Pratt, H. D., *Mites of Public Health Importance and Their Control,* U.S. Department of Health, Education, and Welfare, Rockville, Maryland, 1963. 28 pp.

Pratt, H. D. and K. S. Littig, *Lice of Public Health Importance and Their Control,* U.S. Department of Health, Education, and Welfare, Rockville, Maryland, 1967. 16 pp.

Pratt, H. D. and J. S. Wiseman, *Fleas of Public Health Importance and Their Control,* U.S. Department of Health, Education, and Welfare, Rockville, Maryland, 1963. 36 pp.

Scott, H. G. and K. S. Littig, *Flies of Public Health Importance and Their Control,* U.S. Department of Health, Education, and Welfare, Rockville, Maryland, 1966. 40 pp.

Scott, H. G. and H. D. Pratt, *Scorpions, Spiders, and other Arthropods of Minor Public Health Importance and Their Control,* U.S. Department of Health, Education, and Welfare, Rockville, Maryland, 1959. 27 pp.

Scott, H. G., *Household and Stored-Food Insects of Public Health Importance and Their Control,* U.S. Department of Health, Education, and Welfare, Rockville, Maryland, 1966. 55 pp.

Training and Consultation Activities in Rodent Control, U.S. Department of Health, Education, and Welfare, Rockville, Maryland, 1969. 11 pp.

Weinburgh, H. B., and Harry D. Pratt, *Culicoides—Public Health Importance,* U.S. Department of Health, Education, and Welfare, Rockville, Maryland, 1967. 42 pp.

PESTICIDES

Inspectors' Manual For State Food and Drug Officials, Department of Health, Education, and Welfare, Food and Drug Administration, Rockville, Maryland

Pesticide Information and Safety Manual, University of California, Agricultural Extension Service, Berkeley, California

Pesticides Monitoring Journal, Published Quarterly by the Federal Committee on Pest Control, U.S. Department of Health, Education, and Welfare, Food and Drug Administration, Rockville, Maryland

Model Pesticide Use and Application Act, Association of American Pesticide Control Officials, East Lansing, Michigan

The Regulation of Pesticides in the United States, U.S. Department of Agriculture, Department of Health, Education, and Welfare, Washington, D.C.-Rockville, Maryland, 1968

Report of the Secretary's Commission on Pesticides and Their Relationship to Environmental Health, U.S. Department of Health, Education, and Welfare, Rockville, Maryland, December 1969

Rohrman, Douglas E., *Pesticide Laws and Legal Implications of Pesticide Use*, U.S. Department of Health, Education, and Welfare, National Communicable Disease Center, Atlanta, Georgia

The Safe Use of Pesticides, 16 mm color film, 21 minutes, sound, U.S. Department of Health, Education, and Welfare, Food and Drug Administration, Rockville, Maryland

Summary of Registered Agricultural Pesticide Chemical Uses, Vol. 1, 2 and 3, Pesticides Regulation Division, Agricultural Research Services, U.S. Department of Agriculture, Washington, D.C.

Uniform State Food, Drug, and Cosmetic Bill, Association of Food and Drug Officials of the U.S., Secretary-Treasurer, Topeka, Kansas

RESIDENTIAL

A Decent Home, The Report of the President's Committee on Urban Housing, GPO, Washington, D.C., 1968

APHA-PHS Recommended Housing Maintenance and Occupancy Ordinance, U.S. Department of Health, Education, and Welfare, Public Health Service, Publication No. 1935, GPO, Washington, D.C., 1969

Basic Housing Inspection, U.S. Department of Health, Education, and Welfare, Public Health Service, Bureau of Community Environmental Management, Rockville, Maryland, 1969

Basic Housing Code, Building Officials Conference of America (BOCA), Chicago, Illinois

Building the American City, Report of the National Commission on Urban Problems, GPO, Washington, D.C., 1969

First Report of Expert Committee on the Public Health Aspects of Housing, World Health Organization Technical Series No. 225, Geneva, Switzerland, 1961

Knittel, Robert E., *Organization of Community Groups in Support of the Planning Process and Code Enforcement Administion*, U.S. Department of Health, Education, and Welfare, Rockville, Maryland, Public Health Service Publication No. 1997, GPO, Washington, D.C., 1970

Krasnowiecki, Jan, *Model State Housing Societies Law*, University of Pennsylvania, U.S. Department of Health, Education, and Welfare, Rockville, Maryland, Public Health Service Publication No. 2025, GPO, Washington, D.C., 1970

Legal Remedies for Housing Code Violations, National Commission on Urban Problems, Research Report #14, GPO, Washington, D.C.

National Commission on Urban Problems, Research Report #19, GPO, Washington, D.C.

New Approaches to Housing Code Administration, National Commissioner on Urban Problems, Research Report #17, GPO, Washington, D.C.

Nix, Harold L., *Identification of Leaders, and Their Involvement In The Planning Process*, Institute of Community and Area Development, Department of Sociology and Anthropology, University of Georgia, Public Health Service Publication No. 1998, GPO, Washington, D.C., 1970

Parratt, Spencer, *Housing Code Administration and Enforcement*, Syracuse University, U.S. Department of Health, Education, and Welfare, Rockville, Maryland, Public Health Service Publication No. 1999, GPO, Washington, D.C., 1970

Southern Standard Building Code, (Housing Section), Southern Building Code Congress, the National Institute of Municipal Law Officers, Washington, D.C.

Uniform Housing Code, International Conference of Building Officials (ICBO), Los Angeles, California

INSTITUTIONS

Conditions of Participation: Extended Care Facilities, (Regulations) U.S. Department of Health, Education and Welfare, Social Security Administration, Rockville, Maryland

Conditions of Participation: Hospitals, (Regulations) U.S. Department of Health, Education, and Welfare, Social Security Administration, Rockville, Maryland

Nursing Homes—Environmental Health Factors—A Syllabus. U.S. Department of Health, Education, and Welfare, Public Health Service Publication No. 1009. Reprint 1967. U.S. Gov't Printing Office, Washington, D.C.

Problems in Planning Urban School Facilities, Bulletin No. 23, U.S. Department of Health, Education, and Welfare, Office of Education, Rockville, Maryland, 1964

Standards for Accreditation of Hospitals, Joint Commission on Accreditation of Hospitals, 645 North Michigan Avenue, Chicago, Illinois

Walton, Graham, *Institutional Sanitation*, U.S. Bureau of Prisons, Washington, D.C. 1965

INJURIES

Accident Prevention, A Handbook for Public Health Nurses, U.S. Department of Health, Education, and Welfare, Public Health Service, Rockville, Maryland, 1961

Accident Prevention in Environmental Health Programs, The American Public Health Association, Inc., New York, 1966

Carbon Monoxide Program Action Kit, U.S. Department of Health, Education, and Welfare, Public Health Service, Rockville, Maryland, 1969

Catalogue of Federal Programs for Individual and Community Improvement, Office of Economic Opportunity, Washington, D.C.

Control of Lead Poisoning in Children, U.S. Department of Health, Education, and Welfare, Public Health Service, Rockville, Maryland, 1970

Demonstration Guide for Prevention of Electric Shock Injury, U.S. Department of Health, Education, and Welfare, Public Health Service, Rockville, Maryland, 1969

Driver Licensing Guidelines for Medical Advisory Boards, U.S. Department of Health, Education, and Welfare, Public Health Service Publication No. 1996, GPO, Washington, D.C., 1969

Final Report of the National Commission on Product Safety, GPO, Washington, D.C.

Fire Demonstration Guide, U.S. Department of Health, Education, and Welfare, Rockville, Maryland

Guidelines for Planning and Implementing an Injury Control Program in Institutions of Higher Learning, American College Health Association, Evanston, Illinois

Halsey, Maxwell N., *Accident Prevention: The Role of Physicians and Public Health Workers*, Editorial Consultants, The American Public Health Association, New York, 1961.

Persons Injured and Disability Days Due to Injury, U.S., July 1965–June 1967, National Center for Health Statistics, Series 10, Number 58, Washington, D.C.

Program Guide for Pedestrian and Cylist Nighttime Visibility Program, Department of Health, Education, and Welfare, Public Health Service, Rockville, Maryland, 1969

OCCUPATIONAL HEALTH

Analysis of Workman's Compensation Laws, 1970 Edition. Chamber of Commerce of the United States, 1605 H. Street, N.W., Washington, D.C. 20006. Price $1.50 (Updated annually)

Annual Directory of Governmental Occupational Health Personnel, Bureau of Occupational Safety and Health, Public Health Service, DHEW, 1014 Broadway, Cincinnati, Ohio 45202

Community Health Nursing for Working People, U.S. Department of Health, Education and Welfare, Rockville, Maryland, PHS Publication No. 1296, GPO, Washington, D.C. Revised 1970

County Business Patterns, U.S. Department of Commerce, Bureau of the Census, Published periodically for each State and for the United States. Superintendent of Documents, GPO, Washington, D.C. 20402

Cralley, L. V., Cralley, L. J., and Clayton, G. D., *Industrial Hygiene Highlights*. Published by Industrial Hygiene Foundation of America, Inc., 231 Centre Avenue, Pittsburgh, Pennsylvania 15232. (Now Known as the Industrial Health Foundation.)

Gafafer, W. M., *Occupational Diseases, A Guide to Their Recognition*, PHS Publication No. 1097, GPO, Washington, D.C., 1964

Hosey, A. D., and Lorice Ede, *A Review of State Occupational Health Legislation*, U.S. Department of Health, Education, and Welfare, Rockville, Maryland, 1969

Hosey, A. D., and Powell, C. H., *Industrial Noise—A Guide to Its Evaluation and Control*, PHS Publication No. 1572, GPO, Washington, D.C., 1967

Lindquist, M. D., and Maxine Hurley, *Community Health Nursing for People Who Work*, Occupational Health Nursing, August 1969

Local Health Official's Guide to Occupational Health, American Public Health Association, 1740 Broadway, New York, New York 10019

Morgis, G. G., Beauregard, Lena P., and Shoub, Earle P., *State Compensatory Provisions for Occupational Diseases*. Bulletin 623, Bureau of Mines, U.S. Department of the Interior, 1967. Government Printing Office, Washington, D.C. 20402. Price $1.25 (paper cover).

Occupational Health Hazards, Their Evaluation and Control, Bureau of Labor Standards, U.S. Department of Labor, Bulletin No. 198, GPO, Washington, D.C., 1963

Occupational Health Survey of the Chicago Metropolitan Area, U.S. Department of Health, Education, and Welfare, Bureau of Occupational Safety and Health, Rockville, Maryland, 1969

Powell, C. H., and Hosey, A. D., *The Industrial Environment—Its Evaluation and Control—Laboratory Manual*, PHS Publication No. 614, Volume II, GPO, Washington, D.C.

Powell, C. H., and Hosey, A. D., *The Industrial Environment—Its Evaluation and Control—Syllabus*, PHS Publication No. 614, Volume I, GPO, Washington, D.C., 1958

Publications List, American Medical Association, 535 North Dearborn Street, Chicago, Illinois 60610. Contains publications on industrial medical department, community health resources, and related areas.

State Workmen's Compensation Laws. Bulletin 161 (Revised 1969). Bureau of Labor Standards, Wage and Labor Standards Administration, U.S. Department of Labor, Washington, D.C. 20210. U.S. Government Printing Office, Washington, D.C. 20402. Price 40 cents. (Single copies available free from Bureau of Labor Standards.)

RECREATION

Environmental Health Practice in Recreational Areas, U.S. Department of Health, Education, and Welfare, Rockville, Maryland, PHS Publication #1195, GPO, Washington, D.C., 1968

Environmental Health Guide for Travel Trailer Parking Areas, U.S. Department of Health, Education, and Welfare, Rockville, Maryland, 1966

General Policy Guidelines for Outdoor Recreation, Circular #2, Recreation Advisory Council, Washington, D.C., April 9, 1964

Manual of Individual Water Supply Systems, U.S. Department of Health, Education, and Welfare, Rockville, Maryland, GPO, Washington, D.C. Revised 1962

Manual of Septic Tank Practice, U.S. Department of Health, Education, and Welfare, Rockville, Maryland, PHS Publication #526, GPO, Washington, D.C., 1967

Outdoor Recreation For America, Outdoor Recreation Resources Review Commission, Washington, D.C., 1962

Policy Governing the Water Pollution and Public Health Aspects of Outdoor Recreation, Circular #3, Recreation Advisory Council, Washington, D.C., April 9, 1964

Recommended Practice For Design, Equipment and Operation of Swimming Pools and Other Public Bathing Places—Tenth Edition, American Public Health Association, New York, New York, 1957

Suggested Ordinance and Regulations Covering Private Residential Swimming Pools. American Public Health Association, (soon to be published)

Suggested Ordinance and Regulations Covering Public Swimming Pools, American Public Health Association, New York, New York, 1964

Swimming Pools and Natural Bathing Places—An Annotated Bibliography, 1957–1966, U.S. Department of Health, Education, and Welfare, Rockville, Maryland, PHS Publication #1586, GPO, Washington, D.C.

FOOD

An Evaluation of the Salmonella Problem, National Academy of Sciences, Washington, D.C., 1969

Food Service Sanitation Manual Including a Model Food Service Sanitation Ordinance and Code, U.S. Department of Health, Education, and Welfare, Food and Drug Administration, Rockville, Maryland, 1962

Grade A Pasteurized Milk Ordinance, 1965 Recommendations, Department of Health, Education and Welfare, Public Health Service, Food and Drug Administration, Rockville, Maryland

Inspectors Manual for State Food and Drug Officials, U.S. Department of Health, Education, and Welfare, Food and Drug Administration, Rockville, Maryland

Methods of Making Sanitation Ratings of Milksheds, U.S. Department of Health, Education, and Welfare, Rockville, Maryland, Food and Drug Administration, 1966

National Shellfish Sanitation Program Manual of Operations, U.S. Department of Health, Education, and Welfare, Food and Drug Administration, Rockville, Maryland, 1965

The Procedure for Evaluating Food Service Sanitation Programs (tentative), Department of Health, Education, and Welfare, Public Health Service, Food and Drug Administration, 1967

Procedures Governing the Cooperative State-Public Health Service Program for Certification of Interstate Milk Shippers, U.S. Department of Health, Education, and Welfare, Rockville, Maryland, Revised 1969

Procedures For The Investigation of Foodborne Disease Outbreaks, 2nd Edition, International Association of Milk, Food and Environmental Sanitarians, Inc. 1966.

Procedure for the Standardization and Certification of Food Service Sanitation Survey Officers, Department of Health, Education, and Welfare, Public Health Service, Food and Drug Administration, 1967

Uniform State Food, Drug, and Cosmetic Bill, Association of Food and Drug Officials of the United States, Topeka, Kansas

The Vending of Food and Beverages, Department of Health, Education, and Welfare, Public Health Service, Food and Drug Administration, Rockville, Maryland, 1965

Sanitation Standards for Smoked Fish Processing, Part I, Fish Smoking Establishments, Department of Health, Education, and Welfare, Public Health Service, Food and Drug Administration, 1967

DRUGS, THERAPEUTIC DEVICES, AND COSMETICS

Control Procedures in Drug Production, University of Wisconsin, University Extension, 432 N. Lake Street, Madison, Wisconsin 53706, 1966

Good Drug Manufacturing Practices: No Margin for Error, 16 mm color film, 25 minutes, sound, U.S. Department of Health, Education, and Welfare, Food and Drug Administration, Rockville, Maryland

Inspectors Manual for State Food and Drug Officials, U.S. Department of Health, Education, and Welfare, Food and Drug Administration, Rockville, Maryland

Uniform State Feed Bill and Proposed Rules and Regulations Under the Uniform State Feed Bill, Assn. of American Feed Control Officials, Topeka, Kansas

Uniform State Food, Drug and Cosmetic Bill, Assn. of Food and Drug Officials of the United States, Topeka, Kansas

OTHER PROBLEMS

Manual of Septic Tank Practice, U.S. Department of Health, Education, and Welfare, Rockville, Maryland, PHS Publication No. 526, GPO, Washington, D.C., 1967

Recommended State Legislation and Regulations, U.S. Department of Health, Education, and Welfare, Rockville, Maryland, PHS Publication No. 1451, GPO, Washington, D.C., 1965

Uniform Plumbing Code, International Association of Plumbing and Mechanical Officials, Los Angeles, California, 1961

A Sanitary Standard for Manufactured Ice, U.S. Department of Health, Education, and Welfare, Rockville, Maryland, PHS Publication No. 1183, GPO, Washington, D.C., 1964

Green, Ned, *How to Serve Food at the Fair*, The Paper Cup and Container Institute, Inc., New York, New York.

Food Service Sanitation Manual, (See Chapter on "Food")

Report of Public Health Service Technical Committee on Plumbing Standards, U.S. Department of Health, Education, and Welfare, Rockville, Maryland, PHS Publication No. 1038, GPO, Washington, D.C., 1962

Environmental Health Guide for Mobile Home Parks,
(See Chapter on "Recreation.")

Natural Disaster Program, Order 4000.1, Office of Emergency Planning Regional Operating Guide, (May 1963)

ORGANIZATIONS

American Conference of Governmental Industrial Hygienists
1014 Broadway
Cincinnati, Ohio 45202

Air Pollution Control Association
4400 Fifth Avenue
Pittsburgh, Pennsylvania 15213

American Industrial Hygiene Association
25711 Southfield Road
Southfield, Michigan 48075

American Institute of Landscape Architects
3757 Wilshire Boulevard
Los Angeles, California 90005

American Institute of Planners
917 Fifteenth Street, N. W.
Washington, D.C. 20005

American Medical Association
535 North Dearborn Street
Chicago, Illinois 60610

American Mosquito Control Association
Post Office Box 278
Selma, California 93662

American National Standards Institute
1430 Broadway
New York, New York 10018

American Public Health Association
1740 Broadway
New York, New York 10019

American Public Works Association
1313 East Sixtieth Street
Chicago, Illinois 60637

American Society of Civil Engineers
345 East 47th Street
New York, New York 10017

American Society of Heating, Refrigerating, and Air Conditioning Engineers
345 East 47th Street
New York, New York 10017

American Society of Mammalogists
The Museum
Oklahoma State University
Stillwater, Oklahoma 74074

American Society of Planning Officials
1313 East Sixtieth Street
Chicago, Illinois 60637

American Society of Professional Biologists
University of Kentucky
Lexington, Kentucky 40506

American Water Works Association
2 Park Avenue
New York, New York 10016

Association of American Food Control Officials
Department of Biochemistry
Purdue University
Lafayette, Indiana 46207

Association of American Pesticides Control
1615 South Harrison Road
East Lansing, Michigan 48823

Association of Food and Drug Officials of the United States
P. O. Box 1494
Topeka, Kansas 66601

Association of State Planning and Development Agencies
1130 Seventeenth Street, N. W.
Washington, D.C. 20036

Association of State and Territorial Health Officers
State Department of Health
Bismarck, North Dakota

Conference of Directors of Health Facility Licensing and Certification
c/o State Department of Health
Room 238, 84 Holland Avenue
Albany, New York 12208

Conference of Local Environmental Health Administrators
Erie County Health Department
605 City Hall
Buffalo, New York 14202

Conference of State Sanitary Engineers
Room 6019, 200 "C" Street, S. W.
Washington, D.C. 20204

Council of State Governments
Iron Work Pike
Lexington, Kentucky 40505

Preceding page blank

Ecological Society of America
Oak Ridge National Laboratory
Oak Ridge, Tennessee 37831

Entomological Society of America
4603 Calvert Road
College Park, Maryland 20740

International Association of Milk, Food and Environmental Sanitarians, Inc.
P.O. Box 437
Shelbyville, Indiana

Illuminating Engineering Society
345 East 47th Street
New York, New York 10017

International City Managers Association
1313 East Sixtieth Street
Chicago, Illinois 60637

National Association of Boards of Pharmacy
77 West Washington Street
Chicago, Illinois 60602

National Association of Counties Research Foundation
1001 Connecticut Avenue, N. W.
Washington, D.C. 20036

National Association of Housing and Redevelopment Officials
The Watergate Building
2600 Virginia Avenue, N. W.
Washington, D.C. 20037

National Environmental Health Association
1550 Lincoln Street, Room 208
Denver, Colorado 80203

National Mosquito Control-Fish and Wildlife Management
Coordination Committee
U.S. Department of Agriculture
Plant Industry Station
Beltsville, Maryland 20705

National Pest Control Association
The Buettner Building
250 West Jersey Street
Elizabeth, New Jersey 07207

National Safety Council
425 North Michigan Avenue
Chicago, Illinois 60611

National Sanitation Foundation
P. O. Box 1468
2355 West Stadium Boulevard
Ann Arbor, Michigan 48106

National Society of Professional Engineers
2029 K Street, N. W.
Washington, D.C. 20006

National Swimming Pool Institute
2000 "K" Street, N. W.
Washington, D.C. 20006

National Tuberculosis and Health Association
1790 Broadway
New York, New York 10019

Recreational Vehicle Institute
2720 Des Plaines Avenue
Des Plains, Illinois 60018

Urban Land Institute
1200 Eighteenth Street, N. W.
Washington, D.C. 20006

U.S. Conference of City Health Officers
1612 K Street, N. W.
Washington, D.C. 20006

Wildlife Management Institute
709 Wire Building
Washington, D.C. 20005

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE REGIONAL OFFICES

Region I John F. Kennedy Federal Office Building Boston, Massachusetts 02203	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
Region II Federal Building 26 Federal Plaza New York, New York 10007	New Jersey, New York, Puerto Rico, Virgin Islands
Region III 401 North Broad Street Philadelphia, Pennsylvania 19108	Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, West Virginia
Region IV 50 Seventh Street, N. E. Atlanta, Georgia 30323	Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee
Region V New Post Office Building 433 West Van Buren Street Chicago, Illinois 60607	Illinois, Indiana, Minnesota, Michigan, Ohio, Wisconsin
Region VI 1114 Commerce Street Dallas, Texas 75202	Arkansas, Louisiana, New Mexico, Oklahoma, Texas
Region VII 601 E. 12th Street Kansas City, Missouri 64106	Iowa, Kansas, Missouri, Nebraska
Region VIII Federal Office Building 19th and Stout Streets Denver, Colorado 80202	Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming
Region IX Federal Office Building 50 Fulton Street San Francisco, California 94102	Arizona, California, Hawaii, Nevada, Guam, American Samoa, Trust Territories of Pacific Islands, and Wake Island
Region X Arcade Plaza Building 1319 Second Avenue Seattle, Washington 98101	Alaska, Idaho, Oregon, Washington

☆ U. S. GOVERNMENT PRINTING OFFICE : 1971 O - 405-752